The Wireless World

4D

THE PRACTICAL RADIO JOURNAL

Covering Every Wireless Interest

Friday, December 7th, 1934.

BURTON

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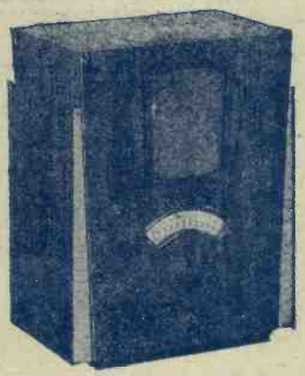

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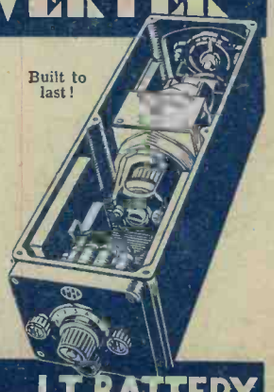

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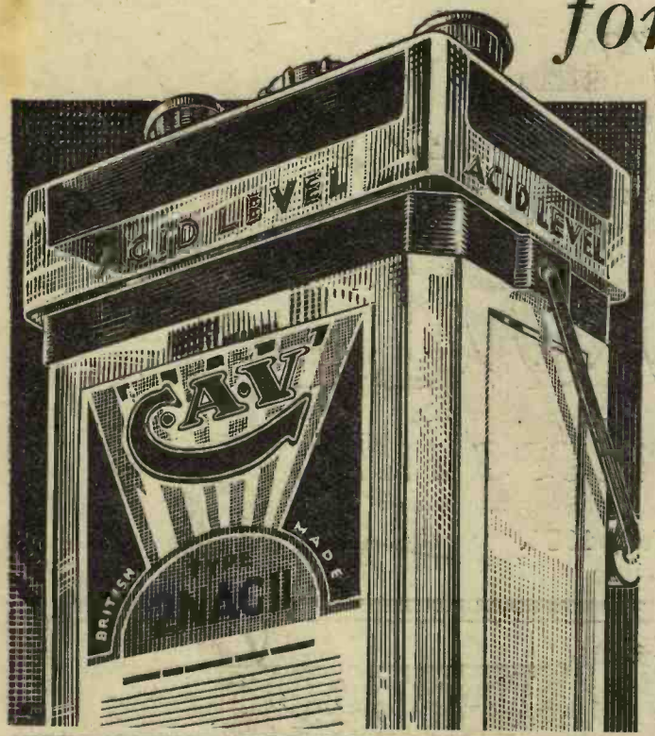

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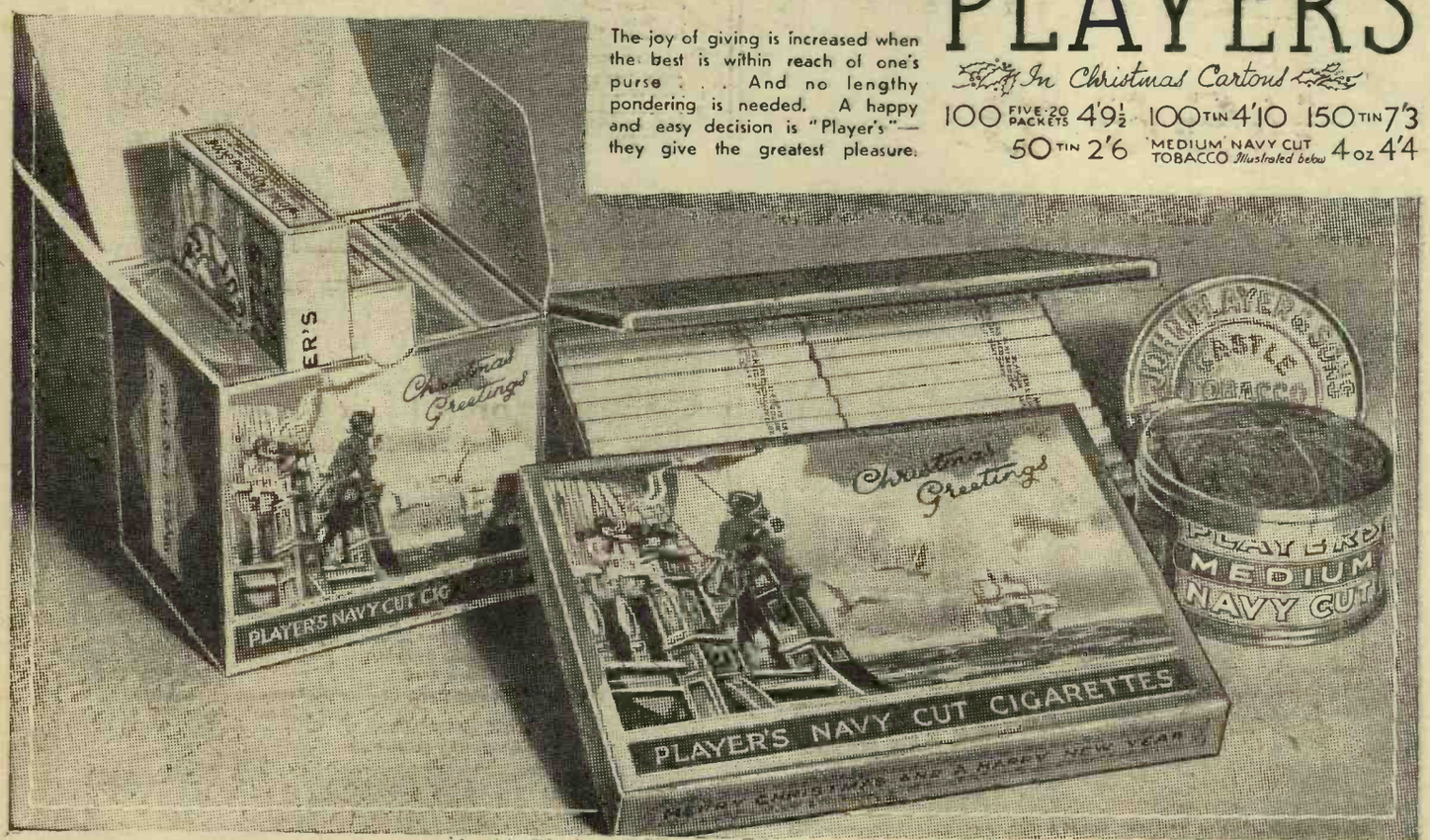

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At Christmas, more than at any other time, your radio entertainment must be at its best. So use a J.B. 'Linacore' tuner for your set—it gives a 3-valve set performance equal to a Superhet. There are three models.

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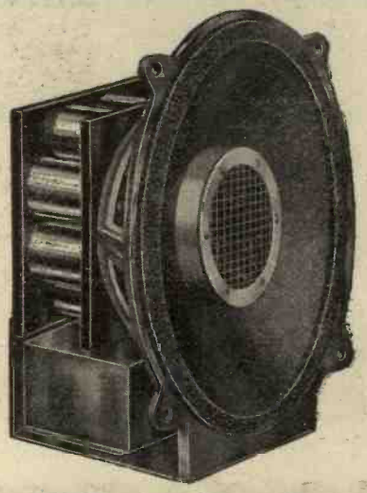

For Christmas

If you would like to make *this* an outstanding Christmas in your wireless experience, buy a Blue Spot Super Dual Speaker. By fitting this speaker, which is not only amazingly sensitive but which responds to a frequency band twice as wide as that of a normal speaker, you will bring out of your set qualities which you did not know were there. To hear the Blue Spot Super Dual is a new experience.

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Two movements concentrically mounted, the larger cone being completely free-edged. Frequency response 40 to 10,000 c.p.s. Bass frequency resonance at 32 c.p.s. (inaudible). Transformers and Input Filters tapped for Universal matching. Very powerful magnets give a high degree of sensitiveness, and even the most powerful amplifier will not overload the loudspeaker.

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A really outstanding speaker giving a remarkable degree of naturalness in reproduction. It has a wonderful magnet, die-cast chassis, novel exterior suspension, independent on/off switch, and many other features.

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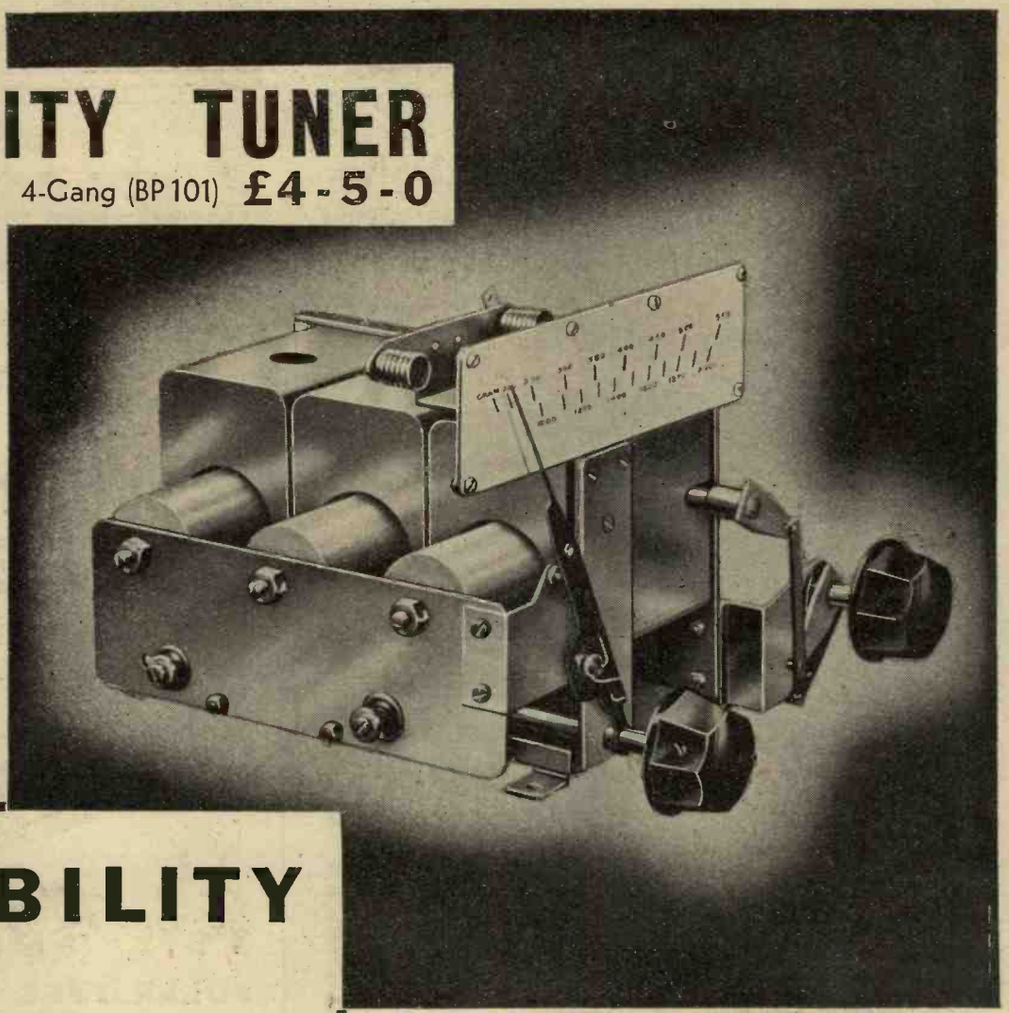
3-Gang (BP 100) **£3-7-6** 4-Gang (BP 101) **£4-5-0**



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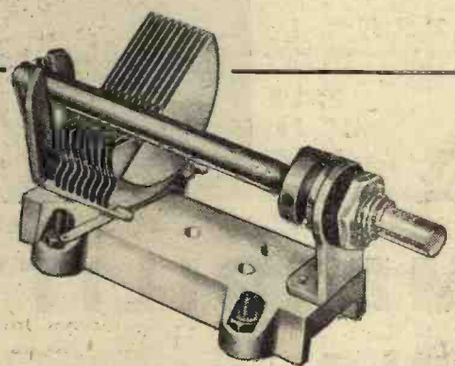

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10,000 ohms 1 watt
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150,000 " " "
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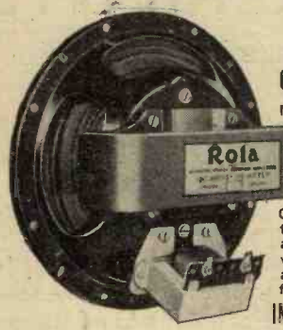

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New Dust-Proof Filter Assembly, radically new Spider Construction and Domed Centre Cap in Apex of Cone, are features of the Rola F.R6-P.M. and F6-F.E. models which set new standards in maintained performance supremacy.

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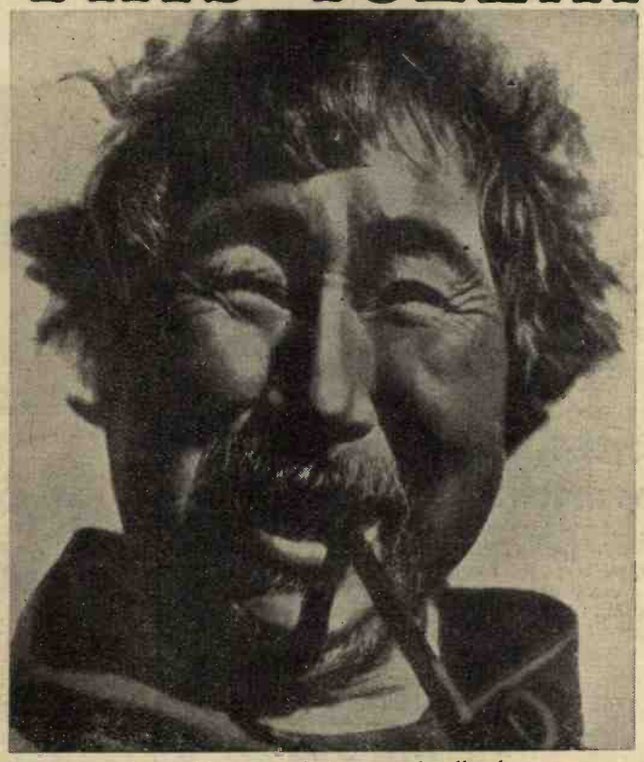

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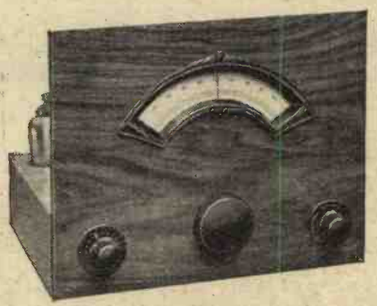
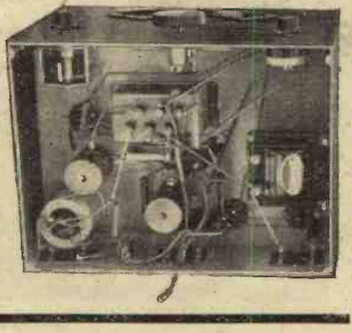
Three views of the Kilodyne 4.





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EDDYSTONE KILODYNE 4

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(1930)

"Radio Data Charts" provide designers of wireless apparatus with a ready and convenient means of solving problems without having recourse to complicated formulæ and mathematics.

By the use of the charts it is possible to tackle all the more familiar problems in radio receiver design, such as, for example, finding the relationship between inductance capacity and frequency, and working out the design of high frequency transformers. All keen amateurs will appreciate this helpful book.

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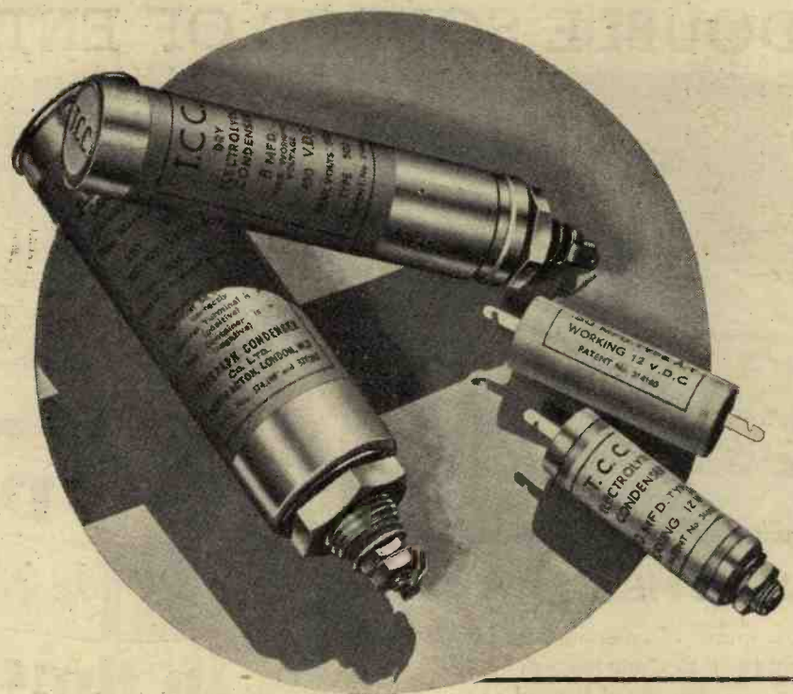

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Special attention is drawn to the Tubular Types "A.T." and "C" with their "manufacturer's" facilities for ease of wiring and mounting. Use T. C. C. Condensers and give your set that "professional look"—and DEPENDABILITY.

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10	50 D.C.	2	3	2	6
20	50 D.C.	2	9	3	0
25	25 D.C.	2	3	2	6
50	12 D.C.	2	3	2	6

Type "AT" with soldering tags. Type "C" one hole chassis fixing.

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TYPE NO.	CAPACITY MFDS.	MAX. WORKING VOLTS.	PRICE s.	PRICE d.
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"HIS MASTER'S VOICE" RADIO

The Wireless World

THE PRACTICAL RADIO JOURNAL
24th Year of Publication

No. 797. FRIDAY, DECEMBER 7TH, 1934. VOL. XXXV. No. 23.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.
Telegrams: "Autocar, Coventry" Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Receivers of To-day

The Case of the Loud Speaker

IN this issue and the two numbers which are to follow, readers will find additional pages devoted to an illustrated description of the season's receivers, summarising the features of each model and indicating special points of individual interest. These issues will, we think, prove very useful to our readers, as nowhere else can they obtain this information collected together in a convenient form.

In these issues sets and radio gramophones will be divided up into categories for ease of reference and each category will be arranged in alphabetical order under the names of the manufacturers.

An Analysis

In the process of preparing these pages it has come as rather a surprise to find how very few manufacturers design sets with the intention that the loud speaker should be used separated from the set itself. When there are so many advantages from the listener's point of view in having two instruments so arranged that they can be separated and the speaker placed in the most convenient position in the room, it seems astonishing to us that each manufacturer should not have arranged that at least one of his models should be so designed.

Many sets are provided with an extra pair of terminals for an extension loud speaker, but this is not the same thing. In such cases the manufacturers almost invariably have in mind that the extension speaker would be in use in some other part of the house and listened to whilst the main set was also in operation. There are hardly any sets where the provision for the extension loud speaker is not quite subservient to the rest of the design, even though a good many now make provision for turning off the loud speaker contained in the set whilst leaving the extension speaker in operation.

It would be fair to say that in the case of the large radio-gramophones there is considerable justification for incorporating the speaker or battery of speakers in the same cabinet. In the case of a battery of speakers, connections, etc., might be unduly complicated for separation, and the solid construction of the cabinet is such as to provide a good baffle and freedom from box resonances. Nevertheless, even in such cases, although convenience may dictate this compromise, the arrangement can never be regarded as ideal.

Manufacturers seem rather too prone to accept standardisation in a matter of this kind, when it would be so easy to try out public response by having a model available where the loud speaker was independent.

Advantages of Separation

The separation of the two units would provide the user with opportunities, which are not at present available to him, to use improved types of speakers with sets which would do justice to them instead of being compelled to use only the particular type of speaker originally installed in the set. Although this consideration is of interest, there are many other important advantages which would in nearly all cases result from ability to place the loud speaker in the ideal position in the room from the listener's point of view and to have the set itself in such a location that it could be operated conveniently. The present position is that almost invariably ideal conditions of listening are never achieved, for the reason that in order to be able to operate a set the loud speaker, being a part of it, is brought far too close to the listener.

The Wireless World

New Single-Span Battery Four

An Economical Four-valve Superhet Receiver

RECENT articles in "The Wireless World" have contained details of the latest developments in single-span tuning, which have been embodied in a receiver designed for economical battery operation. The points of special importance are the new aerial filter and a novel reaction system.

By W. T. COCKING

A RECEIVER of the battery-operated type, although apparently simpler than a mains model, may set its designer an even more difficult problem, for not only are the valves available less efficient but the power consumption must be kept very small if the operating costs are not to be prohibitive. Even in these days of quiescent output systems it is rarely feasible to provide as large an output as that commonly associated with even the smaller class of mains set. It is not difficult, however, to obtain an output in the region of 1,000 milliwatts while still preserving economy, and although the purist will justly demand a considerably greater output for the finest reproduction, it is sufficient for a high standard of quality, provided that it is not wasted by the use of an inefficient type of loud speaker.

The two chief quiescent output systems are Class "B" and QPP, and with them it is possible economically to obtain maximum outputs of roughly 2,000 milliwatts and 1,000 milliwatts respectively. Although not excessive, the current consumption of the former is the greater, simply because it gives a greater output. Experience with the two systems shows that it is difficult to obtain as good reproduction with Class "B" as with QPP, particularly at low volume levels, and the distortion is often most noticeable on the transient sounds of the piano. It is easy to see the reason for this when it is remembered that the two systems are essentially the same as far as the anode circuit of the output valve is concerned, and are consequently likely to be on a par as regards distortion at this point. The essential difference lies in the input, for grid current is permitted to flow in Class "B" working but not in QPP. Grid current necessarily means that the preceding stage distorts, and although this distortion can be kept at a low value at the expense of anode current consumption or amplification, or both, it cannot be completely eliminated. It is theoretically possible so to arrange matters that the distortion introduced by the driver valve balances that caused by the output valve, but it is extremely difficult to arrange this

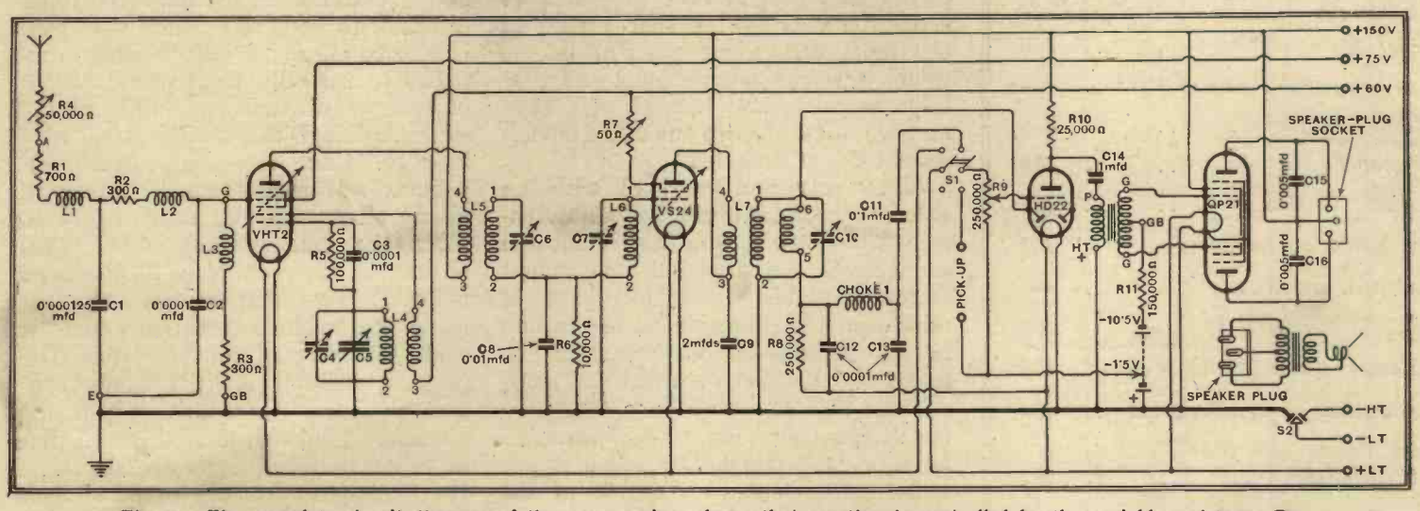


Fig. 1.—The complete circuit diagram of the new receiver shows that reaction is controlled by the variable resistance R7.

satisfactorily in practice, so that we must conclude that in its present form Class "B" is less desirable than QPP from the quality viewpoint.

The LF Equipment

We decide, therefore, to employ a quiescent push-pull output stage and with one of the double pentode valves, such as the QP21, an output of some 900 milliwatts is obtainable with an HT supply of 150 volts, and the quiescent current consumption is no more than 6 mA. When operated with its correct load impedance such a stage is capable of giving very good reproduction. It is necessary, however, to take precautions against parasitic oscillation, for should this occur it will result in serious distortion. Unlike the Class "B" stage, it is usually easy to prevent parasitic oscillation with QPP, and the insertion of a resistance of 150,000 ohms in the lead to the centre-tap on the input transformer is very effective. This resistance is shown as R11 in Fig. 1, and the only other precaution needed is the use of by-pass condensers C15 and C16 across each half of the output transformer primary. With these simple precautions parasitic oscillation is a most unlikely occurrence.

The maximum input required by such a stage is 21 volts peak, so that it is necessary to feed it through a high ratio transformer. The component employed has a ratio of 1-8 and is resistance-capacity fed from the preceding stage by the 25,000 ohms resistance R10 and the 1 mfd. condenser C14. This stage is the triode section of a duo-diode-triode, and it need give an output of no more than 2.625 volts peak. The valve itself gives an amplification of 12.6 times and consumes 1.5 mA. with −1.5 volts grid bias. The LF volume control R9 is included in its grid circuit and functions on both radio and gramophone, while the switch S1 permits the change over to be made.

On gramophone S1 breaks the filament circuit of the two early valves so that they consume no anode or filament current and interference from broadcasting is avoided. The fidelity obtained on gramophone is governed largely by the LF transformer, and the overall response curve of the purely LF equipment is shown by the dotted curve of Fig. 2. At 50 c/s the response falls by about 8.5 decibels and this is advantageous in that it prevents the output stage from being overloaded by frequencies which cannot be reproduced at audible strength unless the maximum available output greatly exceeds 1 watt. At high frequencies the response is substantially flat up to 5,000 c/s and falls only 11 db. at 10,000 c/s.

Turning now to the radio side of the equipment, the LF valve derives its input from the output of one of the diodes which functions as a detector. The diode is fed with the modulated carrier by a winding on the coil assembly L7, having one half the number of turns of the tuned winding. The load resistance R8 is given a value of 250,000 ohms and the by-pass condenser C12 is of 0.0001 mfd. capacity. A filter comprising the HF choke Ch1 and the 0.0001 mfd. condenser C13 is included to restrict HF currents to their proper circuits, and the coupling to the LF valve is completed through the 0.1 mfd. condenser C11.

The preceding stage consists of a variable-mu valve which is operated at a fixed bias of zero volts. This is permissible with a battery valve since grid current does not flow until the grid potential is appreciably positive with respect to negative LT. The coupling between the valve and the diode detector comprises a three-winding transformer L7, on which the basic winding is the tuned secondary. Since the IF valve is of fairly high AC resistance a 1-1 ratio between primary and secondary gives the best amplification and is satisfactory from the selectivity viewpoint. A 1-1 ratio between the secondary and tertiary, which feeds the diode, also gives the greatest amplification, but poor selectivity. The best compromise is reached with a ratio of 1-2, and with this a stage gain of 58.5 times can be obtained with good selectivity.

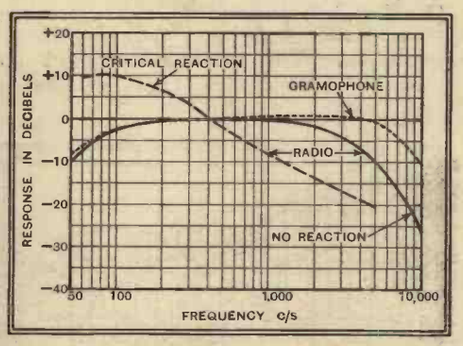
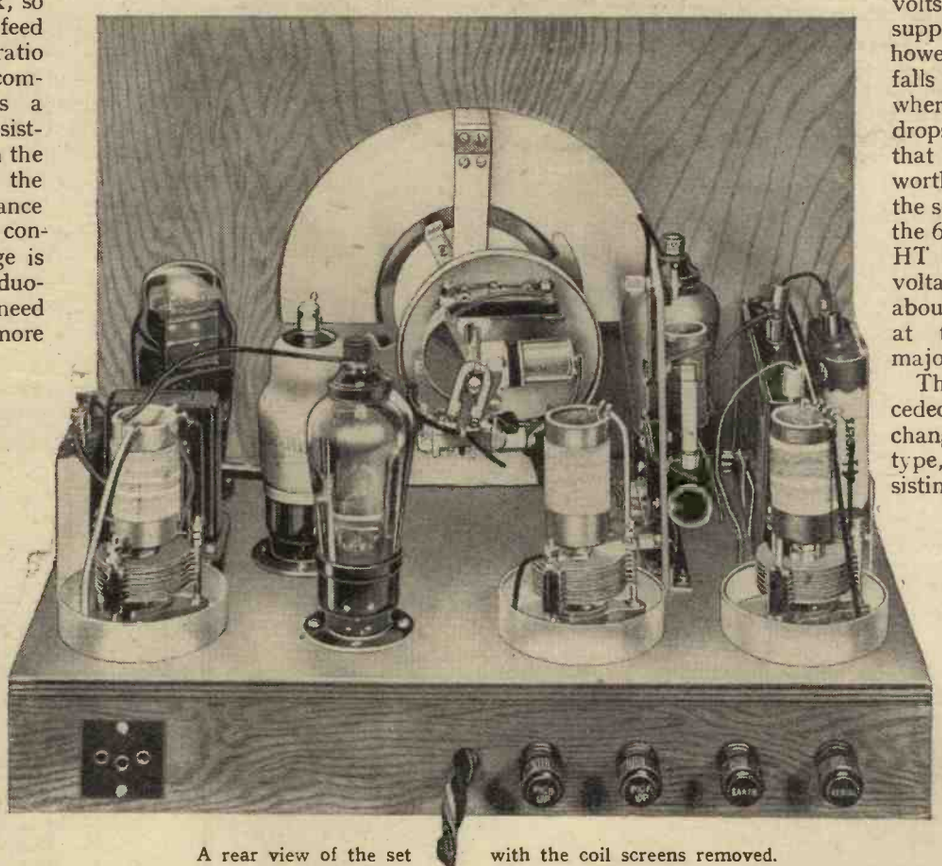


Fig. 2.—The fidelity curves of the complete receiver are shown here for both gramophone and radio.

The amplification obtainable, of course, depends on the operating potentials of the IF valve, and it was found that the greatest amplification for a given anode current consumption is obtained by using a high anode voltage with zero grid bias. The full HT supply of 150 volts is accordingly applied to the anode, and with this the optimum screen potential from the point of view of amplification is about 70 volts. By using a screen supply of some 56 volts, however, the amplification falls by only 9 per cent., whereas the anode current drops by 59 per cent., so that the saving is well worth while. Actually, the screen is operated from the 60-volts tapping on the HT battery, for the true voltage will soon fall to about 56 volts and remain at this figure for the major portion of its life.

The IF valve is preceded by a frequency-changer of the heptode type, the coupling consisting of two coupled tuned circuits of band-pass form, but actually loosely linked for the sake of selectivity. The first circuit L5 is a transformer of 1-1 ratio, since the AC resistance of the heptode is fairly high, and the second, L6, is a single coil. The circuits are tuned by the two air-dielectric trimming condensers, C6 and C7 respectively, and the coupling is provided by the common capacity C8 of 0.01 mfd., the 10,000 ohms resistance R6 being included so that there is a conductive path between the grid and the filament of the IF valve.



A rear view of the set with the coil screens removed.

New Single-Span Battery Four—

The intermediate frequency is 1,600 kc/s, so that to receive signals in the range of 150 kc/s to 1,500 kc/s (2,000-200 metres) the oscillator need tune over the range of 1,750 kc/s to 3,100 kc/s only. This can be covered by a small variable condenser in conjunction with a single coil, so that waveband switching is unnecessary. The tuned winding of the oscillator coil assembly L4 is included in

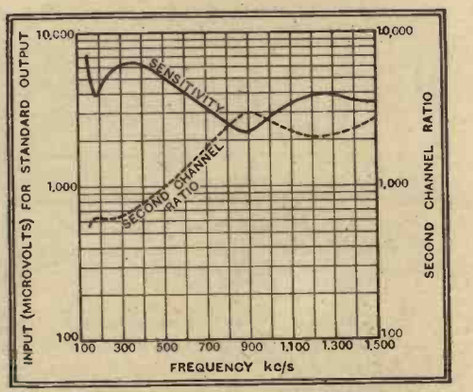


Fig. 3.—The sensitivity and second channel ratio are shown by these curves. The use of reaction increases the sensitivity over ten times.

the oscillator grid circuit, and tuning is carried out by the 0.00016 mfd. condenser C5, the adjustable condenser C4 being for the purpose of obtaining the correct minimum capacity. The oscillator anode circuit includes the reaction coil, which is coupled very tightly to the tuned winding in order to secure maximum conversion conductance. The oscillator anode itself is operated at about 60 volts, and the grid lead includes a 100,000 ohms resistance R5 in order to obtain the correct operating potential. The heptode screen is taken to a 75-volts tapping, and the anode is run from the full 150 volts, these potentials having been found to give the best performance with the valve selected.

Second Channel Interference

Owing to the use of a high intermediate frequency, second channel interference from any station within the tuning range is an impossibility, and it can only occur from stations on wavelengths below 100 metres. It is permissible, therefore, to dispense with signal frequency tuning, thus making the oscillator condenser C5 the only tuning control and eliminating any need for ganging. An aerial filter which passes the required range of frequencies and cuts off others may be used, therefore, and the development of a new type of filter was described in a recent issue of *The Wireless World*.[1] It is essentially a band-pass type of filter, and the values of L1, L2, C1, C2, R1 and R2 are selected for an even response over the range of 550 kc/s to 1,500 kc/s, with a sharp cut-off at higher frequencies. The response over the range of 150 kc/s to 280 kc/s, the long waveband, is maintained through the agency of R3 and the coil L3.

The sensitivity obtainable with a receiver of this type is quite constant with frequency save for two factors—the variation in efficiency of the aerial filter and the change in effective stage gain of the frequency-changer. The latter is quite small, but it falls off a little at the lower frequencies, with the result that the shape of the sensitivity curve differs somewhat from the curve of the filter alone. The carrier input, modulated 30 per cent. at 400 c/s, for the standard output of 50 milliwatts is shown by the solid line curve of Fig. 3. This is without reaction, and the effect of using regeneration is merely to reduce the input needed for standard output by a factor constant for all signal frequencies. Using reaction, the input need be only one tenth to one twentieth of the figures indicated by the curve.

The dotted curve of the same figure shows the second channel ratio, that is, the number of times an interfering station must be stronger than the wanted one for it to give the same output. The ratio varies between 500 times and 3,000 times, and as the wanted station will usually be itself much stronger than any which could cause interference, it can be seen that the possibility of second channel interference has virtually been eliminated.

The adjacent channel selectivity depends entirely upon the IF circuits, and although it is only of a moderate order when reaction is not employed, it is unusually high for the modest number of tuned circuits employed and the high frequency at which they operate. When reaction is used, however, the selectivity is enormously increased and becomes adequate for general distant reception. This is well brought out by the curves of Fig. 4, which show the selectivity both with and without reaction.

LIST OF PARTS

1 Aerial filter (R1, R2, R3, C1, C2, L1, L2, L3) Wearite
or set of parts comprising:
2 Paxolin tubes, ¾in. dia. x 1¾in. long
1 bobbin (see text)
2 resistances, 300 ohms, 1 watt
1 resistance, 700 ohms, 1 watt
1 condenser, 0.000125 mfd. } Accurate to within plus
1 condenser, 0.0001 mfd. } or minus 5 per cent.
Quantity No. 38 DSC and 42 DSC wire
Mounting board, brackets, etc.

3 IF coils, L5, L6, L7 Wearite
or 3 Paxolin tubes, 1in. dia. x ¾in. long Wearite
Quantity No. 32 DSC and 36 DSC wire

1 Oscillator coil assembly, L4 Wearite
or 1 Paxolin tube, ¾in. dia. x 2¼in. long Wearite
Quantity No. 36 DSC wire
(Goltone)

1 Variable condenser, 0.00016 mfd., C5 Polar Type "E"

1 Tuning dial Eddystone 973

1 Compression condenser, 0.0001 mfd., C4 Colvern

3 Variable condensers, 0.0001 mfd., C6, C7, C10 Eddystone 900

3 Knobs Bulgin K6

3 Screening cans, 2¾in. dia. x 3¾in. height Goltone R9/321
(Mains Power Radio)

1 Screening can, 3¼in. dia. x 4¼in. height Goltone R9/322
(Colvern)

1 Variable resistance, 50,000 ohms, R4 Haynes Radio
(Bulgin, Colvern, Watmel)

1 Variable resistance, wire-wound, 50 ohms, with knob, R7
Kabi—F. W. Lechner & Co., Ltd., 61, Spencer Street, London, E.C.1.

1 Tapered volume control potentiometer, 250,000 ohms, R9 Ferranti Type "PG"
(Claude Lyons, Magnum, Rothermel)

Resistances:
1, 10,000 ohms, 1 watt, R6, Erie
1, 25,000 ohms, 1 watt, R10 Erie
1, 100,000 ohms, 1 watt, R5 Erie
1, 150,000 ohms, 1 watt, R11 Erie
1, 250,000 ohms, 1 watt, R8 Erie
(Bryce, Dubilier, Ferranti, Graham Farish, Claude Lyons, Polar-NSF, Watmel)

Fixed condensers:
1, 0.1 mfd. tubular, C11 TMC Hydra T24
1, 0.01 mfd. tubular, C8 TMC Hydra T17
2, 0.005 mfd. tubular, C15, C16 TMC Hydra T15
3, 0.0001 mfd. tubular, C3, C12, C13 TMC Hydra T3
1, 1 mfd., C14 TMC Hydra 25
1, 2 mfds., C9 TMC Hydra 25
(Dubilier, Graham Farish, Peak, Polar-NSF, T.C.C., Telsen)

2 Valve holders, 5-pin Clix Chassis Mounting Standard Type

2 Valve holders, 7-pin Clix Chassis Mounting Type
(Goltone)

1 Screened HF choke, Ch1 Bulgin HF8
(Wearite)

1 QPP transformer, ratio 1 : 8 Lissen LN5306
(Graham Farish, Multitone)

1 QMB toggle switch, DPDT, S1 Bulgin S89

1 QMB toggle switch, 3-point, S2 Bulgin S87

1 Speaker plug and socket, 3-way Belling-Lee 1119

4 Ebonite shrouded terminals, A., E., Pick-up (2) Belling-Lee "B"

1 Connector, 6-way Bryce

1 Battery cable, 6-way, with terminals and spade ends Goltone R59/472

5 Wander plugs, 2 GB+, 1 GB−, 1 GB−1, 1 GB−2 Clix "A"

1 GB battery, 4½ volts

1 GB battery, 9 volts

2 GB battery clips Bulgin No. 2

1 HT battery, 150 volts

1 LT accumulator, 2 volts

1 length Screened sleeving Goltone

1oz. No. 22 tinned coper wire, 6 plengths Systoflex, wood, etc.

Wood panel, 14in. x 10½in.

Plymax baseboard, 9 x 14 x ¾in. Peto-Scott

Screws: 20 ¼in. No. 4 R/hd.; 20 ⅜in. No. 4 R/hd.; 4 ⅜in. No. 4 R/hd.; 1 ¾in. No. 6BA with nut and washers.

Valves: 1 Ferranti VHT2; 1 Osram or Marconi VS24; 1 Osram or Marconi HD22; 1 Osram or Marconi QP21

Loud speaker with universal or QPP transformer W.B.PMS2 Stentorian

Cabinet C.A.C. Cabinets, Ltd.

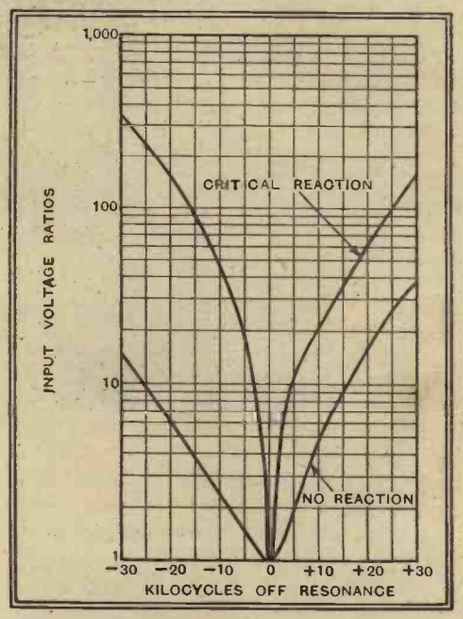


Fig. 4.—The selectivity, both with and without reaction, can be gauged from these curves.

The Fidelity Curves

When reaction is not used the fidelity is the same as on gramophone, save for a slight loss of bass (about 1.5 db.) due to the coupling from the diode, and for some reduction in the high frequency response, caused partly by losses in the detector circuit and partly by sideband cutting. The results obtained are shown by the full-line curve of Fig. 2, and it can be shown that for good reproduction up to some 6,000 c/s a curve of this shape is correct, owing to the tendency of the loud speaker in conjunction with the pentode type out-

[1] *The Wireless World*, November 16th, 1934.

New Single-Span Battery Four—

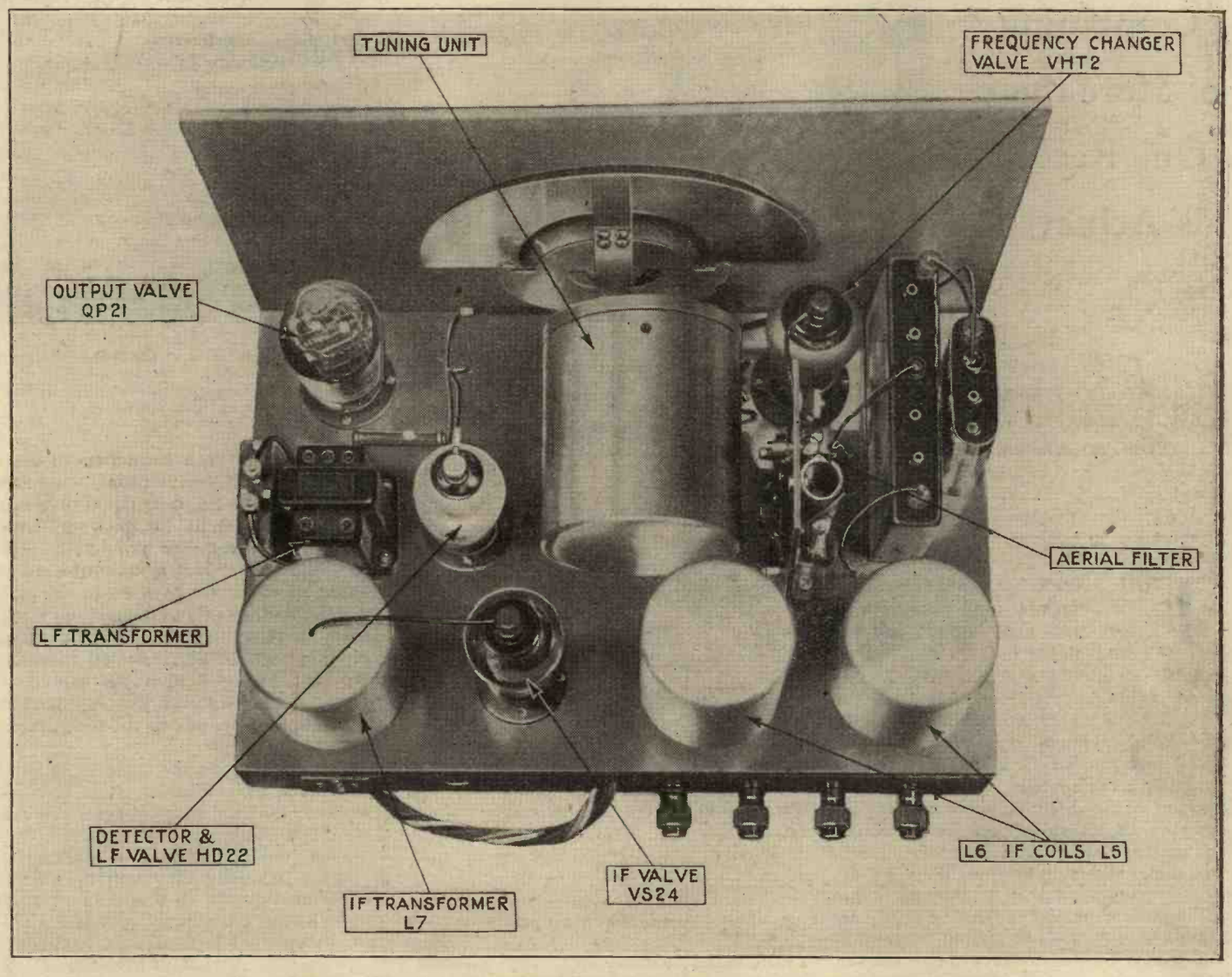
put stage to accentuate the upper register. The response on gramophone is actually too good and will often have to be reduced in the manner indicated later.

The use of reaction increases sideband cutting, and so the high frequency response deteriorates as shown by the dash-line. The apparent increase in the bass is due to 400 c/s being taken as the zero level. In general, it will rarely be necessary to use as much reaction as this, and the use of only a moderate amount of reaction will give a better fidelity curve. It can be seen, however, that reaction may be employed not only for the purpose of increasing the sensitivity and selectivity, but also as a tone-control.

The method by which reaction is obtained is unusual but very effective. It is well known that feed-back occurs through the grid-anode capacity of a valve, and that it will cause instability if it be sufficient. It would, therefore, be theoretically possible to obtain reaction simply by connecting a variable condenser between the grid and the anode of the IF valve. This fails in practice owing to the impossibility of obtaining a condenser of the required range, for even the smallest neutralising condenser is much too large. If the screen grid is not at earth potential as far as HF currents are concerned, however, its effectiveness as a screen is reduced, with the result that the apparent control grid-anode capacity is increased. It becomes possible, therefore, to obtain reaction effects by the simple expedient of inserting an impedance in the screen-circuit.

A variable resistance, R7 in Fig. 1, is thus included in the screen lead and makes a very simple and effective reaction control. The value of *resistance* required for self-oscillation is some 60 ohms. All wire-wound variable resistances of normal construction possess some inductance, however, so that a lower value suffices to produce oscillation. Indeed, the resistance is really of less importance than the inductance, so that in this particular position it is essential to employ the specified component.

It may be remarked at this point that AVC is not fitted, since it was found impossible to devise a method which would prove of any practical advantage. Amplified AVC is really out of the question in a battery receiver, and simple diode AVC proved ineffective in controlling the fading of a weak station and incapable of preventing overloading by a strong signal. The difficulty is due in part to the inherent delay in the AVC diode of a battery duo-diode-triode and partly to the particular value of the normal detector input in this receiver. A pre-detector volume control for use chiefly in local reception is included, therefore, and takes the form of a 50,000 ohms variable resistance R4 included in the aerial lead.



The positions of the chief components in the receiver can be clearly seen in this illustration.

LIVING LESS DANGEROUSLY

SPEAKING at a recent meeting of the Association of Supervising Electrical Engineers, Mr. W. Lang, M.I.E.E., dealt with the gradual evolution of the safety measures advocated in the I.E.E. Regulations for the Electrical Equipment of Buildings. According to Mr. Lang, the regulations were originally framed mainly with a view to avoiding fire risks and consequent damage to property. It is only comparatively lately that the risk of danger from electric shock has been taken seriously into account, and it may be that too much stress has been laid on this aspect of the subject, and that the precautions required are unnecessarily elaborate.

RECORD GRAFTING

By
RICHARD ARBIB

How the Combining of More than One Record is Achieved

The new transfer desk at the E.M.I. studios, where four turntables are available for the purpose of grafting from two or more existing records on to a master disc.

FOR various reasons it is sometimes necessary to alter a word or note in a gramophone record. This article describes the "sound surgery" by which the exclusion of one sound and the substitution of another can be achieved imperceptibly. The blending of separate records is also dealt with.

THE average listener is unaware of the gradual improvement that has been made in the last few years in the broadcasting and recording of gramophone records.

As each side of a record has a playing time limited to 4¾ minutes, it must be of considerable interest to listeners to know how the B.B.C. is able to give programmes of records often lasting a quarter of an hour or more without an interval, the change-over from one record to another being imperceptible. Multi-turntables are, of course, used in the B.B.C. Studios, and it is understood that an ingenious method has been adopted by members of the B.B.C. staff to ensure that the change-over is made without a break when a work is being broadcast that is recorded on two or more sides of discs. The usual procedure adopted by B.B.C. announcers is to play through the records before a broadcast and note a distinctive phrase, such as a drum beat, in each record about a quarter of an inch from the end. The needle is then placed on the record just before this phrase, and as soon as it occurs a stop watch is started and immediately the record is finished the watch is stopped; for example, we will say that the time occupied is twenty-five seconds. The next record of the work is then placed on the turn-table and the stop watch started as soon as the needle is slid into the first groove, and stopped as soon as the performance is recommenced. This may give a reading of four seconds, which shows how long it takes to play the grooves on the beginning of the record on which no entertainment is recorded. The procedure which is then adopted during the actual transmission is that when the distinctive phrase on the first record is reached a stop watch is started, and when it shows twenty-one seconds the needle is lowered into the first groove of the second record; thus, immediately the music on one record is finished it should be carried on by that from the second, and so on.

Recording Methods

Different methods are employed for timing sections of records when composite records are being made in the gramophone companies' studios, or records are being used for providing effects when an artist is recording.

The general principles by which gramophone records are made have been described previously in this paper (*The Wireless World*, pages 143 and 144, March 2nd), but details of the latest achievements of E.M.I. engineers in transferring or editing "His Master's Voice," Columbia, and their associated companies' records have not, we believe, been published before. They have now constructed a four-turntable desk, on which each turntable is driven by a gravity motor to ensure absolutely constant and correct speed. Behind each turntable, mounted vertically, is an 8in. circular scale calibrated with five hundred equal divisions, so arranged that as the pick-up moves across the record the pointer revolves round the scale. This is accomplished by having an extension fixed on to the pick-up arm pivot, so that as the pick-up tracks across the record the far end of the extension describes an arc. By an ingenious wire and pulley system the pointer is moved round without any appreciable friction being apparent in the pick-up arm pivot.

Each division on the scale is equal to one groove of a record. It is obvious, therefore, that the pick-up arms are calibrated to a single groove of a record. The engineers are at the moment working on a scheme whereby they will be able to divide up a groove so that a single word can be picked out without difficulty. This has, in point of fact, already been done in practice. A short while ago it was decided to issue in England a record that had been made in America by a comedian, but on which he sung a word which was not considered to be suitable for English ears. As the gramophone companies are always anxious not to release any records which are likely to offend any section of the public, it was decided to pick out the offending word and insert the sound of a steamboat whistle. This was accomplished quite satisfactorily, and the revised record was released.

The way in which a feat of this kind is carried out is that a copy of the original record is played through on the transfer table and re-recorded on a new wax blank. When the offensive word is reached, the volume control operating the pick-up is

Record Grafting—

momentarily turned down, and another volume control in circuit with the pick-up on another section of the desk which is playing the record of a steamboat whistle is turned up.

A similar scheme was used when it was found that a well-known musical comedy star had made a mistake in one line of the chorus of a popular hit. The artist concerned had already left the country on an American tour before the records were processed. The musical committee was in a quandary, as he would not be able to repeat the performance for some months, by which time the song would be out of date. The engineers, by using two copies, produced a new record by grafting a line from the chorus that had been sung earlier on in the performance, in place of the wrong one.

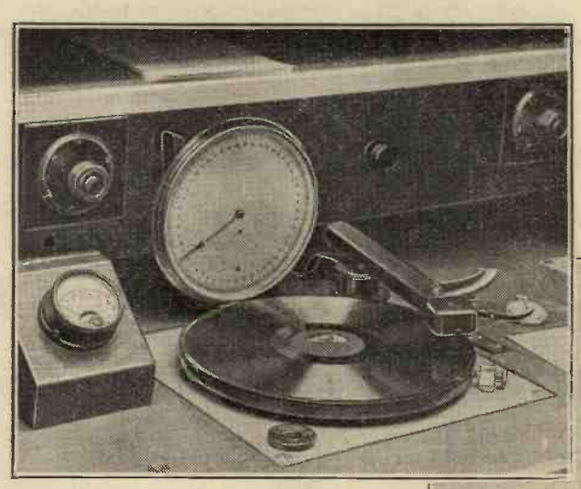
At the Transfer Desk

It is in the editing of public performance recordings that the transfer recording engineers excel. During the military tattoos and similar events as many as thirty records may be made by a mobile recording equipment. These are then processed and sample records played through and the most interesting item selected by a committee. These sections of the record are then calibrated on the transfer desk and re-recorded on to a new record, often being linked together by a commentator, who speaks from a separate studio.

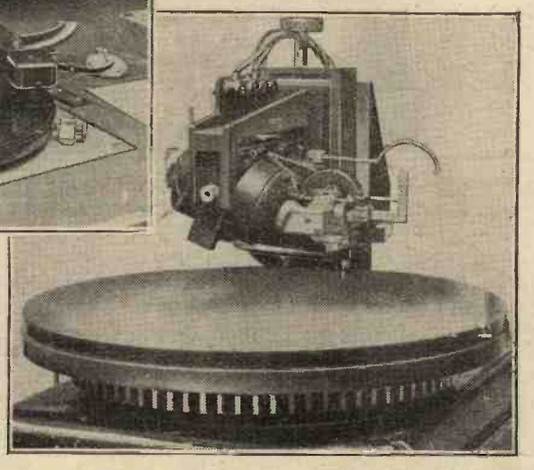
Probably the two most famous examples of a recording engineer's ingenuity have been the records of Caruso singing with a modern orchestra and the disc of Danny Malone singing a duet with himself. In the former case the Caruso record which is to be treated is played through a number of times by the engineers and suitable equaliser circuits designed to flatten out resonances and remove as much as possible the "horn" tone which is apparent in most records made by the acoustic system.

The orchestral conductor has also memorised every note of the record and made suitable orchestrations. As the original accompaniment is, in most cases, extremely weak, the new accompaniment is superimposed on that of the old without the fact being apparent in the finished record. A symphony orchestra is assembled in a studio and the conductor housed in a soundproof cabinet immediately before his musicians, so that he can see them and they can see him through a large glass window. A copy of the original record is played on the transfer table, the volume control being set at a minimum during those passages in which Caruso is not singing and only the old orchestra is playing. The conductor hears Caruso through a loud speaker in his cabinet and is thus able to direct his orchestra so that it is in absolute time with the great tenor's original recording. The volume of the singer in proportion to the orchestra is adjusted by engineers in the recording room. The output from the microphone in the studio, and the amplified sound from the pick-up after it has passed through the filters, are, of course, fed in parallel to the recording instrument, which cuts a new record.

In the making of a duet record the singer first gives an ordinary performance, the record is then processed, and he returns to the studio on another day and sings again whilst listening to it through a pair of headphones, no orchestra being used for the final recording. This system was also adopted when Quentin McClean made a record of a pianoforte concerto with organ in which he played both instruments.



Below is shown the recorder with a new wax blank ready to receive the grafted output from two or more original records. A sapphire stylus is used for cutting the groove.



A close-up of one of the turntables of the transfer table. Behind the record is seen the calibrated scale showing the exact groove on which the pick-up needle is travelling. On the left is the pick-up volume control and meter.

NEW BOOKS

Memories of a Scientific Life, by Sir Ambrose Fleming, M.A., D.Sc., F.R.S., pp. 244 with frontispiece. Marshall, Morgan and Scott, Ltd., London and Edinburgh. Price 3s. 6d. net.

Any book from the pen of Sir Ambrose Fleming is bound to contain a good deal of electrical and wireless interest, and this new book of memoirs is no exception. The volume is written chiefly for the general non-scientific reader, and is illuminated from time to time by short digressions giving simple explanations of various scientific phenomena. The simplicity of these explanations does not, however, render them the less attractive to the technical reader.

The Author.

Although not a consistent autobiography the volume traces the author's long scientific career from start to finish, beginning (after a foreword by Sir Oliver Lodge) with a chapter on "A Juvenile Scientist," and closing with Scientific Friends and Recognitions. The whole is of interest to electrical and wireless readers, since the author was connected with telephony in this country from its very earliest. Naturally the chapter containing reference to the invention of the valve is the most interesting, and the author (writing of the introduction by de Forest of the third electrode) permits himself to regret, "But, sad to say, it did not occur to me to place the metal plate and the zigging wire in the same bulb and use an electron charge of positive or negative on the wire to control the electron current to the plate."

An occasional obvious slip can be detected, one of which is the reference to the National Physical Laboratory as being at South Kensington. J. F. H.

Radio Round the World, by A. W. Haslett. Pp. vii.+ 196. 5s. net. Cambridge University Press.

Clerk Maxwell proved mathematically that wireless waves were possible and predicted their nature more than twenty years before they were actually detected in 1887 by Heinrich Hertz. In "Radio Round the World" the author tells, in simple language, with many delightful and convincing analogies, the whole fascinating story of wireless waves from the time of their prediction by Maxwell to the present day.

The major part of the book is a dissertation on the production of radio waves and the phenomena associated with their propagation round the earth's surface. This is followed by discourses on the future of ultra-short waves, their uses in television and medical science, and the uses of radio at sea and in war.

The book is written in a vein that makes its reading a recreation to the scientifically minded whether they be directly concerned with the science of radio or not. O. P.

Current Topics

Events of the Week in Brief Review

Dickens Night in Brussels

BRUSSELS No. 1 includes in its programme for December 24th "Le Noel de M. Scrooges."

Post Office and Ultra Shorts

THE General Post Office hopes to have a wireless telephone service working on ultra short waves between Belfast and Port Patrick, Scotland, before Christmas. The distance is approximately thirty-five miles.

Electron Optics

DR. L. C. MARTIN, D.I.C., A.R.C.S., will lecture on "The Elementary Theory of Electron Optics" at a meeting of the Television Society on Wednesday next, December 12th, at 7 p.m., at University College, Gower Street, London, W.C.1. Cards of invitation may be had on written application to the hon. business secretary, Mr. J. J. Denton, 25, Lisburne Road, Hampstead, London, N.W.3.

Counting the Instruments

DISCRIMINATING listeners will be interested in a novel competition announced by the makers of Triotron valves. A special gramophone record of the "Blue Danube" is being distributed free in exchange for a coupon printed in the Triotron advertisements, and the competition consists of identifying the number of instruments used by the orchestra in making the record.

German Short-wave Developments

THE German broadcasting authorities have carried out experiments on various wavelengths, using a Post Office experimental transmitter at Döberitz, to find suitable wavelengths for the various new zones which are being opened for the regular short-wave broadcasts. As a result the new transmitter DJN began a regular service on December 1st for the benefit of Southern Asia. It works from 8.45 to 16.30 (G.M.T.) on a wavelength of 31.45 metres. With another beam aerial, experimental transmissions are provided to Central America between 22.15 and 3.25 (G.M.T.).

The German short-wave station has also reserved the following wavelengths for possible future use: DJM, 49.35 metres; DJO, 25.43 metres; DJL, 19.85 metres; DJR, 19.56 metres.

The Wireless League

THE annual general meeting of the Wireless League will be held at 12, Grosvenor Crescent, London, S.W.1, on Wednesday next, December 12th, at 3.15 p.m. All members of the Wireless League are invited to attend.

The One and Only

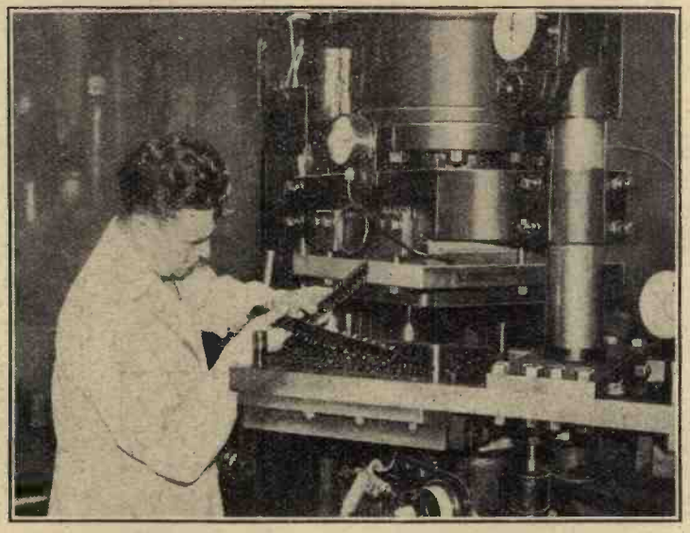
THE town of Lille seems to have been envied by the rest of France on account of its numerous broadcast transmitters. The real truth is that Lille has only one station, but it has been given so many names in the Press, such as Radio-Lille, Lille P.T.T., Lille-Radio, etc., that an erroneous impression has been created. The management have now issued a special circular drawing attention to the fact that the one station in existence in Lille is officially entitled "Radio-P.T.T. Nord."

More Canadian Licences

AGAIN of 45,000 in the number of licensed listeners is reported by the Canadian Department of Marine for the six months from April to September. The Canadian radio licences cost 2 dollars per annum, and the total number of licences issued at the end of September was 548,249.

War in the Ether

A LITTLE war of the ether is being waged between Germany and Lithuania. According to our Berlin correspondent, the trouble began a few days ago when the German Ministry of Posts lodged a complaint with the Lithuanian Government in regard to a telegraphy transmitter near Memel alleged to be systematically interfering with the special programmes from Königsberg intended for Memel listeners.



FIXED CONDENSERS BY THE BUNCH. A scene in the H.M.V. factory, Hayes, showing the 80-ton press which turns out 90 fixed condensers simultaneously.

Records at Christmas

IT has often been dangerous to give gramophone records as Christmas presents for the reason that, should the recipient already possess the number, it is rarely possible to effect an exchange at the shop. Now the "His Master's Voice" Company are introducing a new scheme of Christmas certificates whereby the donor can visit a gramophone dealer and buy a certificate which entitles the recipient to purchase any records of his choice to the value of the certificate.

Soon afterwards a transmitter, announcing in German "Hallo, this is Munke-Punke," started interfering with the Lithuanian station, Radio-Kaunas, which was obliged to change its wavelength from 1,935 to 1,955 metres. Each country now alleges that the other is causing deliberate interference.

The Lithuanian Government has decided to increase the power of Radio-Kaunas and has invited tenders for a high-power station to be erected near Memel. A number of British firms have submitted estimates.

Radio Weather Station

A "NATIONAL aviation meteorological station," whose programmes will consist only of daily weather reports, weather forecasts, and warnings, for airmen, is to be erected by the Marconi Company on behalf of the Air Ministry at Cranwell, Lincolnshire.

The 2-kilowatt transmitter will operate on the wavelength now used by Heston, which it will supersede, namely 1,158 metres (253 kilocycles).

It is probable that most air ports and flying clubs will install suitable receivers to enable their users and members to listen-in to the Air Ministry weather broadcasts from the new station. The station is expected to be opened in the early summer of 1935.

French Regional Scheme

DESPITE the change of French Government, work is being pushed on with the development of the Regional scheme. The Toulouse-Pyrenees transmitter has reached an advanced stage, and first trials with low power are expected at the end of this month, with regular programmes in the early Spring.

At Realtor, a splendid site near Marseilles, 700 feet above sea level, the new Marseilles-Provence transmitter is under construction and may be expected to be operating by next May.

Anti-Static Moves in U.S.

AMERICA has now launched a definite offensive against man-made static. The Institute of Radio Engineers, in collaboration with the Radio Manufacturers' Association, is calling a Committee of outstanding radio scientists to attack the problem. The major effort will be to induce electrical equipment manufacturers to fit proper shielding devices in apparatus turned out from the factories.

Dr. Alfred N. Goldsmith, the well-known radio engineer, has been designated chairman. One Committee member will be provided by each of the following:—Federal Communications Commission, Bureau of Standards, Edison Electrical Institute, American Radio Relay League, Radio Branch of Department of Marine, Dominion of Canada, National Association of Broadcasters, Electrical Testing Laboratories, Institute of Radio Engineers, and the Society of Automotive Engineers.

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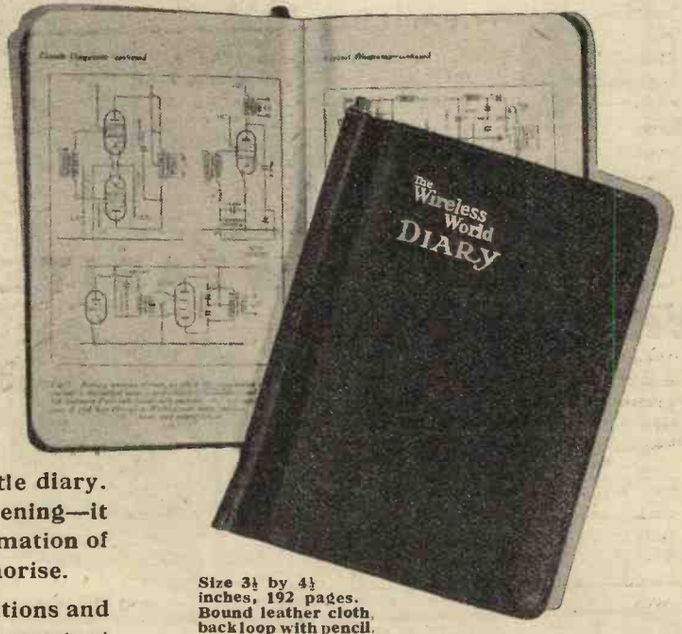
The Wireless World DIARY for 1935



Size 3½ by 4½ inches, 192 pages. Bound leather cloth, back loop with pencil.

Every wireless enthusiast should have this handy little diary. In addition to the usual pages—one week at an opening—it contains 79 pages of facts, formulæ and general information of the kind that is always wanted but is difficult to memorise.

There is a complete list of European Broadcasting Stations and Short-Wave Stations of the World. In addition an important section contains all the essential technical data relating to valves on the British market, including the latest type of frequency changers, pentodes and multi-electrode valves.

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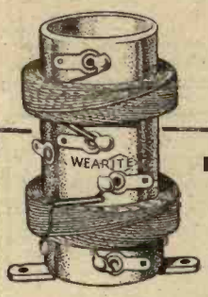

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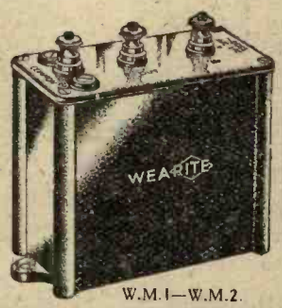

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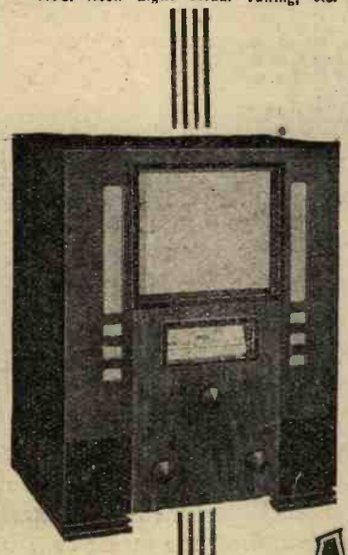

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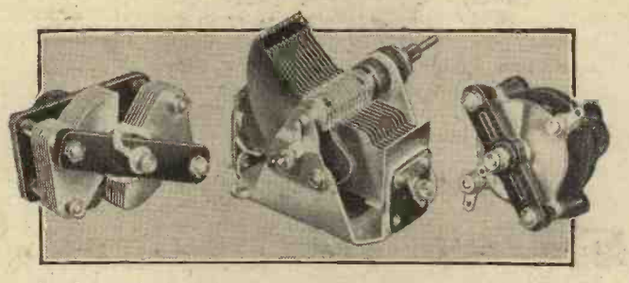
Variable Condensers

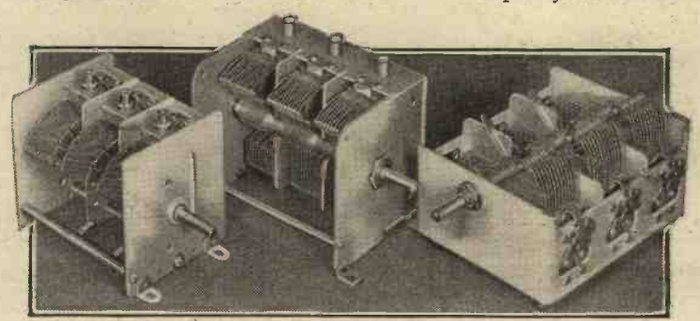
Characteristics of Modern Types

VARIABLE condensers in one form or another are employed in every modern receiving set, but the requirements naturally depend upon the functions which they must fulfil. The characteristics of the chief types of condenser in general use are dealt with in this article, together with the points to look for when selecting a component



An Ormond air-dielectric midget condenser can be seen on the left, and a solid-dielectric differential reaction condenser of the same make on the right. In the centre is a Formo tuning condenser.

IT is generally accepted that a receiver should have only a single tuning control, and as the majority of sets employ more than one variably tuned circuit the tuning elements are mechanically linked together. Condensers still form the variable elements of the circuits, and they are available in two-, three-, and four-gang assemblies, so that it is readily possible to control any number of circuits by a single knob.



A group of three-gang condensers; the ones on the left and right are, respectively, Polar and J.B. straight condensers, while that in the centre is a Utility superheterodyne model.

On the medium waveband, tuning must extend from 550 kc/s to 1,500 kc/s, a frequency or wavelength ratio of 2.725-1, so that the ratio of minimum to maximum capacity must be 7.45-1. The maximum capacity required in a variable condenser does not depend upon its minimum capacity alone, but upon the total stray capacity of the circuit. If the variable condenser gives a change of capacity of 0.0005 mfd., it is easily calculable that the total minimum capacity must be 0.0000775 mfd. in order to obtain the correct waveband coverage. Of this figure the condenser itself may account for 20 mmfds. to 30 mmfds., so that the stray circuit capacities must be kept at some 57.5 mmfds. to 47.5 mmfds., a feat which is often quite difficult.

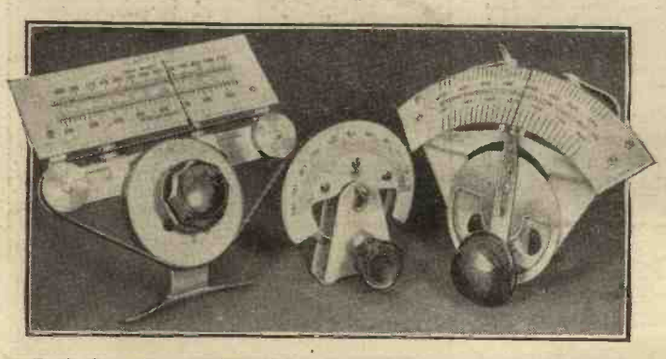
Accuracy of Matching

It is usually impracticable to employ a condenser of smaller maximum capacity than 0.0005 mfd., and it is unnecessary to use a larger one. This figure is now standard, therefore, but the *variation* of capacity is usually somewhat smaller than this figure. Provided that care be taken in keeping stray circuit capacities at a low figure, full waveband coverage can be secured when the coils for the medium waveband have an inductance of 157 μH, and those for the long waveband are of 2,200 μH inductance.

Perhaps the most important part of a gang condenser is the accuracy of matching of its sections, for if the ganging is to hold accurately it is essential that at any dial setting the capacities of all the sections should be alike within very close limits. Until recently it has been customary to express the rating of the condenser by a formula such as "accurate within 1 mmfd. below 100 mmfds. and within plus or minus 1 per cent. for higher capacities." This means, not that the sections are accurate within this amount relative to some arbitrary standard, but to each other. Thus, if at some particular dial setting the capacity of one section is exactly 0.0002 mfd., the capacity of another section might possibly be as high as 0.000202 mfd. or as low as 0.000198 mfd.

For capacities below 0.0001 mfd., however, the percentage error increases, for a constant difference of 1 mmfd. is allowed between sections. When one section has a capacity of 50 mmfds., therefore, the other may be between 49 mmfds. and 51 mmfds., a discrepancy of ±2 per cent. The more accurately a gang condenser is matched the greater are the sensitivity and selectivity of a receiver likely to be, so that accuracy is a matter of considerable practical importance.

Although it is possible accurately to match any type of gang condenser, it will not retain that matching unless it is properly built and carefully handled. The frame must be very rigid, and modern constructions often embody die-casting, although in some cases steel is employed.



Typical modern tuning dials. From left to right, the Utility, the J.B., and the Polar.

Even the most rigid frame may be slightly twisted by screwing it to an uneven bed, so that resilient mounting feet must be considered a necessity. The bearings must be smooth and free from any suspicion of play, and the shaft must not only be perfectly straight, but rigidly fixed to the moving vanes.

The vanes themselves must be cut from the correct type of metal and be free from stress, otherwise they will certainly warp after a time. In many cases they are braced by a cross-strap, but this is not always considered necessary. Often, too, the end vanes of each section are split, and the manufacturer matches the sections by bending these vanes appropriately.

Insulating Material

Although the moving vanes are all mounted on a common metallic spindle, a separate earthing connection for each section must be provided if instability and other results of stray couplings are to be avoided. It is common, therefore, to find a rubbing earth contact arranged on the spindle between each section.

In spite of the stringent mechanical requirements, electrical efficiency must not be forgotten, and the condenser must introduce a minimum of loss into the tuned circuits. The chief source of loss lies in the materials employed for insulating the fixed plates, and here there is room for improvement in most present-day types. The material most favoured is Paxolin, or some paper-base substance of similar nature, and its dielectric properties leave much to be desired. The use of Keramot, or some of the new German materials, would lead to an appreciable improvement.

In parallel with each section of a gang condenser will usually be found a trimmer for equalising the stray capacities of the various circuits. Almost invariably the trimmer has a single moving plate, the position of which relative to the frame can be adjusted by a screw. Mica is used as a dielectric, and, provided that it is of good quality, it has fairly low losses.

The latest types of gang condenser are considerably more accurate than their predecessors, although they may also be physically smaller. It is not uncommon for an accuracy of matching of within plus or minus 0.5 per cent. to be claimed, but it must never be forgotten that, no matter how good a condenser may be, it will not

Variable Condensers—

withstand rough treatment, and it should be handled at least as carefully as a valve. Even with the greatest care it will not last for ever, but mismatching of the sections is likely to occur before wear in the bearings sets a limit to the life. It is almost impossible to obtain metal for the vanes which is completely free from stress, with the result that after a time the accuracy of matching is bound to deteriorate.

Superheterodyne Types

Condensers of this type are widely used in both straight sets and superheterodynes, but types for the latter receiver are available with specially shaped vanes for the section tuning the oscillator circuit. This section has a smaller maximum capacity than the other and is so designed that the oscillator always tunes to a frequency higher than that of the other circuits by the intermediate frequency. Most condensers of this type are designed for an intermediate frequency of 110 kc/s, and it is important that for the medium waveband the signal-frequency coils should have an inductance of 157 μH, and the oscillator coil 126.9 μH, while on the long waveband the inductance of the signal-frequency coils must be 2,200 μH for an oscillator coil of 1,056 μH. A padding condenser is needed for the long waveband. There is a tendency towards the use of a fairly high intermediate frequency in the neighbourhood of 465 kc/s, and this demands a different modification of the oscillator condenser vanes. Few specimens of this type of condenser are yet to be found, however.

Other types of condenser all fall into the single category, and, as they do not call for matching, a simpler construction can be adopted with a relative lowering of the price. Single air-dielectric condensers are not now greatly used, except on the short wavelengths, but solid dielectric types find wide application in reaction circuits and for trimming purposes.

Compression Condensers

Trimming or compression condensers consist of a number of plates of springy metal interleaved by mica, and, as their name implies, the capacity is varied by altering the compression by means of a screw. They are available in capacities up to some 0.002 mfd., and find their way into many different types of receivers, since they may be employed for a wide range of functions.

Reaction condensers are usually of the rotary pattern with a dielectric of bakelised paper, and are available in two distinct types—plain and differential. The latter are provided with two sets of fixed plates for one of moving, so arranged that the capacity to one set decreases as the other increases. In general use, one set is used to control reaction, and the other for the detector anode-cathode by-pass condenser, so that the by-pass condenser is reduced as reaction is increased.

In this brief review of variable condensers it has not been possible to deal with more than the chief types in common use at the present time. Before concluding, however, it may be as well to make some comment on tuning dials. These are probably governed by fashion as much as anything, and the straight horizontal scale seems the favourite to-day. It is, however, less useful than the older semicircular type, for its effective length is usually much shorter, and, consequently, it cannot be read as accurately. The dial nearly always includes the condenser drive, and here it is well to stress the importance of a smooth and definite action free from any trace of backlash or elasticity. A smooth drive of low ratio is infinitely to be preferred to one of high ratio accompanied by backlash, elasticity, or a jerky motion. In most cases a dial is designed for a particular condenser, and it is as well to remember that if the components are not selected to work with one another some difficulty in fitting may be experienced.

ON THE SPOT

Visits to Foreign Broadcast Stations

XX—Bari (Italy), 1059 kc/s, 283·3 metres, 20 kW.

Signorina Rosa di Napoli is chiefannouncer at Bari. (Left) The transmitter building.

AFTER a pleasant ramble past the battle-scarred fortifications frowning over the Adriatic Sea, and through the fine gardens and squares of present-day Bari, I ended my search for the broadcasting station in the Via Putignani. The director,

The studio control room at Bari. Cables connect studios to the transmitter at Ceglie.

Giuseppe Damascelli, greeted me cordially and conducted me round the station.

The 20 kW. voice of Bari, I was told, had penetrated to countries as far flung as New Zealand, China, Japan and Vancouver. Bari is connected by special cables with Rome, Naples and Palermo, Sicily, the stations comprising the EIAR's southern circuit, and exchanges and relay programmes from these stations. Local broadcasts are given every Monday.

The spacious studio with its sawdust-filled walls is somewhat futuristic in design, and in appearance is much more impressive than many other Continental studios.

In a corner of the studio is an ingenious model of the transmitter in the picturesque suburb of Ceglie. Orchestral performances are given in the large studio, and for solo items I found a smaller room. Recording of programmes is carried out extensively by the Italian stations, and in the announcer's studio I noticed a Blattnerphone machine. The usual transmission hours are 12.30 p.m. to 2.15 p.m., 4.30 to 6, and 6.30 to 11.

I was pleased to have a *tête-à-tête* with the announcer, Signorina Rosa di Napoli, whose voice I had previously heard when tuning in to Naples. Rosa, although she has left her native town, still retains her former soubriquet. A talented soprano and an accomplished elocutionist, Rosa is among the most popular announcers in Italy.

A tram with a high-pitched warning whistle reminiscent of an oscillating set took me the six kilometres to the transmitter at Ceglie. The station, with its 240-ft. lattice masts, is situated in a trim little garden. The transmitter is of standard design and is housed in a concrete building which looks like a church.

WANDERLUST.

The Extension Loud Speaker

Various Methods of Connection Discussed

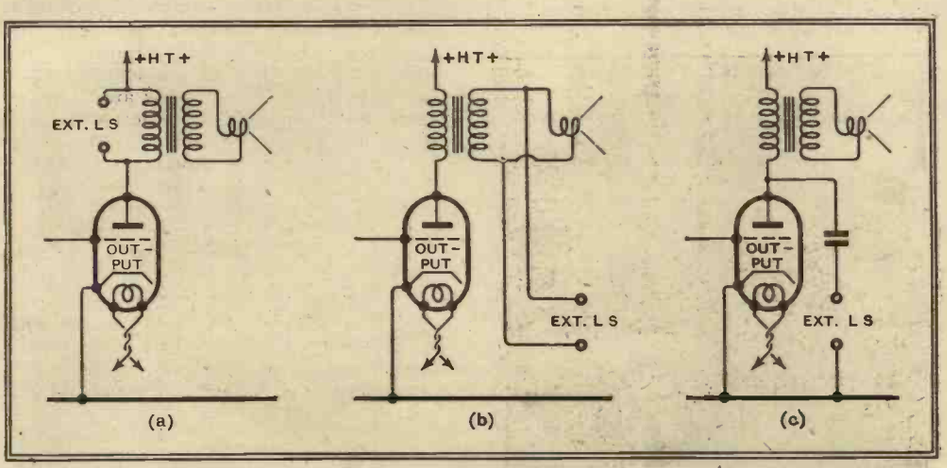
By "CATHODE RAY"

IT is not many weeks since I was writing about the use of an extension loud speaker for getting more realistic reproduction. When one comes actually to carry out a scheme of this kind, or indeed to connect an external loud speaker for any purpose at all, almost the first question that arises is where to tap on to the receiver.

The presence of a pair of neat sockets provided for the purpose may not solve the problem at all, for if the loud speaker is plugged into them the odds are approximately 2 to 1 in favour of failure. Manufacturers have entirely different ideas as to how these sockets should be connected to the internal workings. I have been rather interested in analysing the circuits of the last two seasons' sets, of which I have examined about sixty models from among the well-known makes. Four methods emerge: —

The first method is to provide no facilities at all. As this is of little technical interest, we pass on to the next, which is to put the external loud speaker terminals in parallel with the primary of the output transformer. Another plan is to take them from the secondary of the same transformer. And the last makes use of the transformer primary (or the loud speaker itself) as a choke to divert the output, via a condenser, to the external loud speaker. To compare these three systems, refer to Figure 1.

The first of these (a) is supported by the longest list of makers, including Philips, Ekco, Cossor, McMichael, Telsen, Halcyon, Atlas, Climax, Bush, Sunbeam, Regentone, Lissen and Portadyne; also Marconiphone and G.E.C. (battery models only).



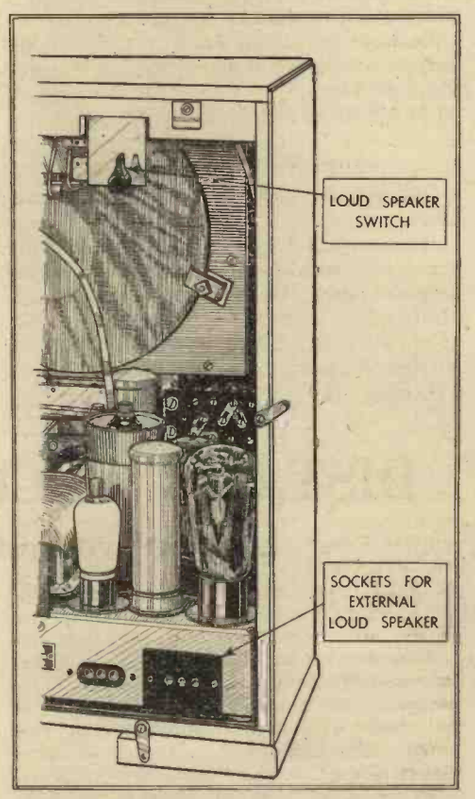
Various methods adopted by the leading set manufacturers for providing suitable terminals for extension loud speakers.

Now although, strictly speaking, an output valve works at its best when it is feeding a definite load, in practice there is a good deal of latitude, more especially with triodes. It is really surprising how little difference it makes to the original loud speaker when one, or even several others, are plugged in. That assumes, of course, that they are all of at least as high impedance. A low impedance loud speaker, such as a moving coil without a transformer, would merely reduce both to a whisper.

Loss of Volume

Suppose the added speaker has the same impedance as the original one. Then with a triode output valve each gives slightly less than half the original volume. If you have never tried it you may find it difficult to believe that this difference is hardly noticeable to the ear. But the vast majority of the sets enumerated use pentodes, and then each speaker gives only a quarter of the output. This really is noticeable. Moreover, there is a greater tendency to distortion near the full volume. Fortunately the modern pentode has a large reserve of power for listeners who do not abuse it by annoying their neighbours, and the drop due to extra loud speakers can be made good by a slight clockwise adjustment of the volume control.

On the whole, it is better for the extra loud speakers to be too high in impedance rather than otherwise; particularly if one does not mind them giving less volume than the internal one. But quite often one may want to cut off the internal speaker altogether. This want, incidentally, is not encouraged by most of the manufacturers, who make no provision for it. Apart from the usual eye on the cost, the probable reason is that the general public cannot be trusted to have the external speaker connected, and kept connected, all the time the other is disconnected. There is risk of damage to person and property if a pentode has its load unplugged.



The addition of a switch to isolate the speaker on the set when the extension speaker only is required is provided on some of the Philips models.

Don't Touch!

Method (a) involves some risk in any case, and does not conform to the I.E.E. Regulations, for the loud speaker terminals are live to the extent of the full H.T. voltage. And a minor drawback is that if the added speaker has a lower resistance than the internal transformer it will take most of the feed current, which may be enough to be undesirable. So some makers adopt it for battery models only, where the voltages and currents are not likely to be large. On the other hand, method (a) for DC or "Universal" sets is likely to lead to strained relations with one's electric supply company if the extension is carried out with the usual haphazard wiring, for it is in direct touch with the mains.

This is probably why Philips and Burndept adopt method (c) for their DC sets. Varley, G.E.C., and C.A.C. are also upholders of this system for AC. The loud speaker is effectively in parallel so far

The Extension Loud Speaker—

as impedance is concerned, but the condenser blocks off the DC voltage and current and enables the speaker to be safely earthed. Incidentally, there is a slight advantage in keeping the extra "signal" current out of the HT source.

Method (b) is favoured by some of the largest and most famous firms in the industry—Ferranti, Pye, Marconiphone, H.M.V., Ultra, Murphy, Kolster-Brandes and R.G.D. Quite a number of them make provision for disconnecting the internal speaker; usually when a triode is used.

The impedance of a loud speaker for (a) or (c) would have to run into thousands of ohms. But it is unlikely that anything much over 10 ohms would be satisfactory for (b). As low as 1 ohm would be right for some sets. The choice depends on what the designer of the internal speaker finds most convenient, and there is no obvious indication of what this is. One has to go rushing around to find the instruction book, and even that may not be of much help. It is extremely unlikely, too, that one's spare speaker will match. Then, again, if the coil impedance is only an ohm or two, the extension wiring must be kept down to a fraction of an ohm, which may mean heavy-gauge wire.

Apart from these possible difficulties there is everything to be said for (b). It is even safer than (c), because the speaker is completely isolated (Philips isolate theirs with *two* blocking condensers) and the signal voltage is far too low to be felt, whereas one can get quite a nasty shock off (c) if the volume is turned well up! So the G.E.C. and Halcyon use (b) for their "Universal" sets.

Perhaps you can say finally which is the best method. I prefer to leave it to you.

DISTANT RECEPTION NOTES

Long Waveband Still a Problem

HAVE you tried recently for transatlantic stations? If you do so you will find that many of them are coming in with wonderful strength even before midnight. WTIC, of Hartford, Connecticut, which works on 288.4 metres, is frequently receivable at an early hour provided that Leningrad and Rennes have closed down. It then has a free channel, and comes in without interference from European stations. Another channel always worth trying is that occupied by Katowice on 395.8 metres. This station often closes down quite early, and then WJZ, New York City, on 394.7 metres, may be heard, provided that the Midland Regional on 391.1 metres can be cut out.

After midnight numerous stations in the United States are to be picked up. Amongst the best of them are WGY, Schenectady; WBZ, New York; WLW, Cincinnati; WABC, New York; KDKA, Pittsburgh; and WCAU, Philadelphia.

Once more France has a new Minister of Posts and Telegraphs! He has a big task in front of him in tackling broadcasting, for at the present time, after so many lightning changes in her PTT Ministers, France has one of the most chaotic broadcasting systems in Europe. One word from a Minister, and the stations do . . . exactly what they like would seem to be a very fair description of the position at present.

The Eiffel Tower, so frequently dead and buried in recent months, is still as lively as ever!

Luxembourg in Trouble

Luxembourg is having rather a bad time just now, as many readers will have discovered for themselves. The whistle which often accompanies both its daytime and its early evening transmissions appears to be due to Kharkov, working but two kilocycles away, and on the other side Warsaw, with a 7-kilocycle separation, also causes trouble. It seems a pity that no solution of the long-wave problem can be found, for at the present time the majority of stations with wavelengths over 1,000 metres are either causing or suffering from interference.

On the medium waveband the Lucerne Plan seems to be working out very well. No station of importance is regularly interfered with, though occasional heterodynes are to be observed on several. Prague, for instance, sometimes has a whistle produced by Barcarena, Lisbon; Breslau is apt to be affected by Algiers; and Bordeaux by Madrid. But on any evening the choice of good programmes from the Continent is a wide one, and the adoption of the Lucerne Plan, in spite of its critics, has very nearly doubled the number of programmes that we may sample at will.

Between 450 metres and the top of the medium waveband some fine stations are to be found evening after evening. Amongst the best of them are Budapest, Beromünster (now in its best form again), Stuttgart, Vienna, Brussels No. 1, Lyons, and Cologne. A little below comes a further good group—Stockholm, Rome, Munich, and Leipzig. The last of these seems to be entirely free from the heterodyne which was such a nuisance a week or two ago.

Finding the Best Stations

Still working downwards, we find a very profitable belt for the long-distance man between 300 and 370 metres. The pick of the stations are Milan, Berlin, Hamburg, Brussels No. 2, the Poste Parisien, and Hilversum.

The next 50 metres between 250 and 300 metres contains only a few stations of note, but most of them are well received as a rule. They include Bordeaux (the heterodyne referred to above is not frequent), Königsberg, Frankfurt, and Hörby.

The lowest part of the medium waveband is chaotic, since so many stations within its limits are making no attempt to work according to the Lucerne allotment. The only good stations in this belt are Nürnberg and Trieste, though Juan-les-Pins is sometimes well heard.

D. EXER.

SCHOOLS RADIO

THE Central Council for School Broadcasting has recently been approving receivers suitable for use in reception of the educational broadcasts to schools.

It is interesting to note that the Council shows a decided preference for the use of a separate speaker mounted on a baffle board for school requirements. Radio Instruments, Ltd., are supplying a separate speaker mounted on a 30in. baffle board for use with their three-valve AC receiver, which has received the approval of the Council. The undistorted output of this receiver is given as 2½ watts.

The range of Ferranti receivers, the Lancastria, the Arcadia, and the Gloria superhets, has received the endorsement of the Council, and their M1+ permanent magnet moving-coil speaker has been approved for use in schools separately and also as an extension speaker to be used with the Ferranti sets mentioned above.

The recommendation of the Central Council for School Broadcasting is a high testimonial of the reproduction, particularly of speech at large volume, as this is the first requirement of a receiver for school broadcasting use.

Mr. J. N. Roe (G 2VV) in his wireless room at St. Margaret's-on-Thames, Middlesex. The AC mains-operated transmitter is a single valve TP-TG using an LS6A or T25D type. The station maintains daily contact with the U.S.A on 20 metres, using 8 or 10 watts.

BROADCAST BREVITIES

By Our Special Correspondent

Breakfast Broadcasts

FROM being a hardy annual the question of breakfast-time broadcasting has become a hardy monthly, and I can say that the matter is at last being conscientiously discussed at Broadcasting House. Morning broadcasts are now within measurable distance.

It is felt that, with programmes already going out at 8 a.m. for the most distant parts of the Empire, very little additional expense would be incurred by "diagonalising" this material on the National wavelength, or, alternatively, broadcasting an original programme from Droitwich which would also be suitable for Empire transmission No. 1 (Australia).

No Physical Jerks

The romance which seems to cling around physical jerks is not likely to be transmitted into English homes at breakfast-time, although, of course, this has long been a leading item in early morning broadcasts in the United States. British listeners may, however, expect to get "something snappy" and not long feature transmissions such as "Wuthering Heights."

And there must be nothing having such a sustained appeal as to cause John Citizen to lose his business train.

Midland Regional Testing

AFTER Droitwich, the new Midland Regional. I learn that the medium-wave station at Droitwich is making good headway, and its radiations may be expected early in January on a wavelength of 296.2 metres. It is hoped to begin regular transmissions in February, when that faithful old transmitter, 5GB, will close down for the last time.

A Hoary Pioneer

5GB was a wonder station when Captain Eckersley opened it in August, 1927. If I am not mistaken, it was this experimental station which inaugurated low-power modulation, which the B.B.C. have stuck to ever since. In a sense 5GB is still experimental; it has never had the finished appearance of its successors in the Regional scheme, the design of which was largely governed by the results achieved at Daventry.

Question and Answer

AFTER two long sessions of "Wuthering Heights" last week I left a message for Mr. Val Gielgud at Broadcasting House pleading for the introduction of intervals in radio plays just as in broadcast opera and concerts. The dramatic producer's reply is that such intervals would serve no artistic purpose.

This is a great consolation to listeners, for, however hard it may be to concentrate on the spoken word for an hour-and-a-half continuously, we may now assume that some artistic purpose is being served.

Holding the Listener

I gather that the Dramatic Department find difficulty enough to hold the listener's attention at any time, and fear that an interval would lose him for the rest of the evening. But surely the "curtain" on the first part could be contrived in such a way that listeners would be left on tenterhooks until the sequel came?

Scotsmen as Correspondents

ALTHOUGH Broadcasting House, London, is the headquarters of the broadcasting system, the provincial centres are jealous of their independence when it comes to correspondence from listeners. A friend who recently visited the Scottish Regional office at Edinburgh tells me that he was shown many letters received from Scotsmen in Canada, Australia, New Zealand and other far-flung Empire outposts—all expressing appreciation of the Scottish material in the programmes.

More Scottish "O.B.s"

A recent innovation in the Edinburgh transmissions has been the introduction of more Scottish dance music, which is proving extremely popular. Edinburgh is also going ahead with ambitious "O.B.s" which have not hitherto figured very largely in the programmes of the North.

Dramatising the Talks

WE wireless men are all more or less interested in the electric grid system, and it is interesting to note that this subject has been chosen for another experiment in dramatising broadcast talks. The talk occurs on December 20th, when, instead of a straightforward account of the construction and potentialities of "The Grid," this new electric system will be brought to light in a vividly dramatised form.

Mr. Salt, who is preparing this feature, feels that there is unlimited material for such talks in the industrial and scientific field, which if given in a prosaic manner might be a complete failure.

FILMING THE B.B.C. A "snap" taken in Queen Street, Edinburgh, last week, showing members of the G.P.O. Film Unit "shooting" the Scottish Regional headquarters.

A Christmas Problem

SO magnetically attractive are the Christmas programmes that there seems a danger of listeners becoming chained to their sets to the neglect of their shopping duties. This thought enables me to be the first to raise the important question: Is the B.B.C. a Menace to Trade?

Two-hour Party

Yuletide fare really begins with the broadcasting of the Nativity Play from St. Hilary, Cornwall, on December 18th.

The Light Entertainment branch gets busy on December 21st and 22nd with the return of the "Ridgeway Parade," and, also on the 22nd, with a special Christmas "Music Hall," arranged by John Sharman. "Entertainment Hour" on Christmas Eve will vibrate with seasonable gaity, which will reach a pitch with the Christmas party on December 25th, lasting from 7.35 to 9.30 o'clock. This broadcast will be arranged by those tireless young men, John Watt and Max Kester.

"Bluebeard" and "Oliver Twist"

On Boxing Day comes the "Bluebeard" pantomime, repeated on December 27th, when the "Café Colette" Orchestra will also appear in a "Seasonable Session."

The Dramatic Department is making a special Christmas effort with "Oliver Twist," to be broadcast on December 27th and 28th under the direction of Howard Rose.

Round the Empire

The round-the-world broadcast on Christmas Day is to be called "Empire Exchange." The aim will be to give listeners a vivid impression of the great diversity of Empire interests against a background of the bells of Bethlehem, the message of which will be echoed by a circle of bells sounding around the British Commonwealth—in India, New Zealand, Canada and Ireland. Big Ben, in London, will be heard striking 2 p.m., and thus establishing London as "Empire Exchange."

H.M. The King

The speech of His Majesty the King will be relayed from Sandringham at 3 p.m., as on previous occasions.

Voices broadcasting from different parts of the Empire will include those of an Indian Army officer in the Khyber Pass, a Canadian fisherman, a native chief in South Africa, a toll-keeper on duty on Sydney Bridge, a tea-planter in South India, and, finally, a party of Chelsea Pensioners at the Royal Hospital, Chelsea.

Honour to Whom . . .

Although the B.B.C. carries the responsibility for this stupendous broadcast, the feat would be impossible without the close co-operation of the engineering branch of the British Post Office, the African Broadcasting Company, the Australian Broadcasting Commission, the Canadian Radio Broadcasting Commission, the Irish Free State Broadcasting Service, the New Zealand Broadcasting Board, the P.M.G.'s Department at Jerusalem, and the Department of Industries and Labour, Government of India.

The Wireless World

Guide to Receivers

A MERE catalogue of broadcast receivers with bald technical specifications makes dull reading. To avoid this we have endeavoured, in presenting our Guide to apparatus available on the British market, to pick out the outstanding and more interesting features of each set and to show in what way it differs from others of its class.

It will save needless repetition to say that, failing a statement to the contrary, it is to be assumed that sets are for operation with an outside aerial (but nearly all these have provision for a mains aerial). Similarly, all receivers are table models except where stated, and power rectifying valves, metal rectifiers, and Westectors are not counted in the total number of valves. Thus there will often be discrepancies between our rating and the makers' rating. Most receivers include provision for connecting external loud speakers and gramophone pick-ups, but in cases of uncertainty, the makers will be pleased to give information on these and similar matters.

CLASSIFICATION:

Radio-gramophones: 30 guineas and above. Radio-gramophones: below 30 guineas. Receivers: 15 guineas and above. Receivers: below 15 guineas and above 10 guineas. Receivers: below 10 guineas.

RADIO-GRAMOPHONES: 30 GNS. AND ABOVE

Special All-wave Model

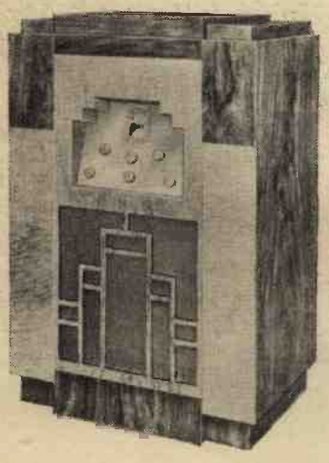
ALLWAVE SUPERHETERODYNE RADIO-GRAMOPHONE 50 gns.

Universal Seven-valve Superheterodyne for AC or DC Mains. Four Wave-ranges: 15–27m., 26–58m., 200–560m., 900–2,000m.

The chassis of this radio-gramophone is basically similar to that of the highly specialised Allwave superheterodyne, which is designed for reception of both short and normal wavelengths. Extra power output is, however, provided, the speaker is larger, and a filter to eliminate needle scratch is fitted.

An important feature of the design is that, as far as is possible, the reception of short waves is made as easy and certain as that of stations on the normal broadcast bands.

Allwave International Radio and Television, Ltd., 242, High Street, Bromley, Kent.



High-fidelity Reproduction

B.S.R. MODEL VS8 85 gns.

Seven-valve Superheterodyne Radio Circuit for AC Mains only. Automatic Record Changer

Twin loud speakers giving a frequency response from 40 to 12,000 cycles and continuously variable selectivity to enable the widest possible frequency response to be obtained on any given station are outstanding features of this instrument. Delayed and amplified AVC and an adjustable noise suppressor control are included, and the large triode in the output stage is capable of an undistorted output of 6 watts. A piezo-electric pick-up is used for gramophone reproduction, and it is evident that the makers have omitted nothing which will help towards the best possible quality of reproduction with the knowledge at present available.

Birmingham Sound Reproducers, Ltd., Claremont Street, Old Hill, Staffs.

(Above) British Radiophone AWG101, with all-wave chassis.

(Left) B.S.R. Model VS8 incorporating variable selectivity.

All-wave Reception

BRITISH RADIOPHONE AWG101 100 gns.

Eight-valve AC Mains Superheterodyne with three Wave Ranges: 15–55 m., 190–560 m., 800–2,000 m.

In the design of an all-wave receiver special attention must be paid to the AVC system if it is to be effective in combating the effects of fading on the shorter wavebands. The time constant of the control system in the present receiver has been shortened with this object in view.

The signal-frequency stage is effective on all wavebands, and true "quiet" AVC is controlled by a separate valve which performs no other function. Another highly desirable fitment for all-wave work is a two-speed drive for the ganged tuning condenser.

The loud speaker is of the large "auditorium" type, and there is an automatic record changer.

The British Radiophone, Ltd., Aldwych House, Aldwych, London, W.C.2.

Special Sound Diffusion System

BURNDEPT RADIO-GRAMOPHONE MODEL 203 32 gns.

Universal Five-valve Superheterodyne for AC or DC Mains, operating on Internal or External Aerial

An unusual system of angular mounting for the twin loud speakers (described as "flood lighting of sound") is a feature of this instrument. The object is to ensure more equal distribution of acoustic radiation.

Due to the relatively large size of the cabinet, space is available for a built-in aerial of more than usually effective dimensions. The circuit arrangement includes an elaborate system of wave-traps for the elimination of second-channel interference.

Burndept, Ltd., Light Gun Factory, Erith, Kent.

Gramophone Record "Postbox"

C.A.C. AUSTIN MODEL "B" 32 gns.

Four-valve Superheterodyne for AC Mains

The C.A.C. model chosen for description embodies a most interesting and novel device which simplifies the mechanical process of playing gramophone records, and thus adds considerably to the æsthetic enjoyment of the listener. This device, known as the Collaro Automatic Record Player, takes a record after it has been placed in a slot, and then relieves the user of all subsequent operations; finally, the played record is passed out through the same slot.

Twin loud speakers are fitted, and the chassis is that of the Austin AC Super, with tone control and AVC.

Other models, with plain equipment and with an automatic

RADIO-GRAMOPHONES: 30 GNS. AND ABOVE

record changer, are sold at 29 guineas and 36 guineas respectively. It should be mentioned that the makers cater especially for unusual requirements in the matter of cabinet work; where required, their productions can be combined with articles of furniture, or housed in cabinets of special design to match existing furnishing schemes.

City Accumulator Co., Ltd., 18-20, Norman's Buildings, Central Street, London, E.C.1.

Refinement in Design

DRUMMER RG8 70 gns.

Eight-valve AC Superheterodyne

Almost every conceivable refinement is included in this "luxury model," which embodies an interstation noise suppressor, automatic tone correction, and uniform sensitivity. Like all other sets made by Edge Radio, it includes iron-cored coils in both signal-frequency and IF circuits. Triode valves (PP3/250's in push-pull) are fitted in the output stage.

A still more ambitious model (RG8 de luxe) is fitted with a crystal high-note speaker.

Edge Radio, Ltd., Bolton, Lancs.

An All-wave "Straight" Receiver

DYNATRON ETHER EMPEROR 130 gns.

Seventeen-valve "Straight" Receiver Circuit for AC Mains only. Automatic Record Changer Standard

The wave-range of this receiver is from 14 to 2,000 metres. There are three stages of HF amplification with Ferrocart coils for the normal wavebands and three additional valves and their associated circuits are used for the short wavebands. Variable selectivity and a new system of LF amplification, using six valves with an output of 12 watts undistorted, are important items of specification.

Alternative Cabinet Styles

DYNATRON "ETHER KING" 75 gns.

Ten-valve "Straight" Receiver Circuit for AC Mains only. Opional Automatic Record Changer

Three HF stages with six Ferrocart tuned circuits and variable selectivity, a separate valve system for amplified and delayed AVC and a high-quality LF amplifier delivering 6 watts, undistorted, are the mains features of the circuit. The instrument is available in a Louis XV walnut cabinet at 75 guineas or in a modern style cabinet at 78 guineas. An automatic record changer may be fitted for an extra charge of 8 guineas.

Quality at Moderate Price

DYNATRON "ETHER KNIGHT" 32 gns.

Six-valve "Straight" Receiver Circuit for AC Mains. Record Changer optional

Retaining the essential Dynatron features designed to give good quality of reproduction, this model has been simplified in design to bring it within the range of those of moderate means. There are two HF stages and diode detection with delayed AVC, and the Dynatron Variable Neon Search-light Tuner is incorporated. An alternative model with universal valves is available at 33 guineas, but in this model the neon pointer is replaced by a travelling light beam.

H. Hacker and Sons, Ray Lea Road, Maidenhead.

Good Sound Distribution

FERRANTI ARCADIAGRAM 30 gns.

Four-valve Superhet. Radio Circuit for AC Mains only

Based on the "Arcadia" receiver, this instrument incorporates the same tuning and indicating dial, and is housed in a cabinet of modern design carried out in walnut and macassar ebony with chromium fittings. The control panel and loud speaker panel are inclined to give a slight upward projection of sound.

The "Arcadia" Autogram is a similar instrument incorporating an automatic record changer, and costs 39 guineas.

Ferranti, Ltd., Hollinwood, Lancs.

Regardless of Expense

H.M.V. HIGH-FIDELITY AUTORADIOGRAM MODEL 800 110 gns.

Thirteen-valve AC Superheterodyne; 13–80 metres and Normal Broadcast Wavelengths

Technically speaking, designs into which price considerations do not enter are always the most interesting. Hardly a single known refinement is absent in the H.M.V. "luxury" model, but perhaps its most valuable feature is variable selectivity, whereby the frequency response may be adjusted to suit prevailing conditions. A device for the restoration of musical contrast is of almost equal interest.

Naturally, the gramophone equipment is in keeping with the rest of the set, and an automatic record changer is fitted.

Adjustable Band Width

H.M.V. DUO-DIFFUSION AUTORADIOGRAM 48 gns.

Eight-valve AC Superheterodyne

Although less ambitious than the "high-fidelity" model, this instrument includes many unusual refinements. For example, the variable selectivity control, whereby the acceptance band width may be adjusted to either 4 or 8 kc/s, should provide valuable help towards the elimination of heterodyne interference.

A new form of loud speaker, with a large reinforced elliptical diaphragm, is designed to improve the distribution of sound and to strengthen high-note response without the need for a separate "tweeter." An automatic record changer and the latest type of pick-up are fitted.

Triode Output

H.M.V. SUPERHET FLUID-LIGHT AUTORADIOGRAM 33 gns.

Four-valve AC Superheterodyne

Without reviving the old controversy with regard to the triode-pentode output valve question, it may be said that many listeners prefer the three-electrode valve, as fitted to this model.

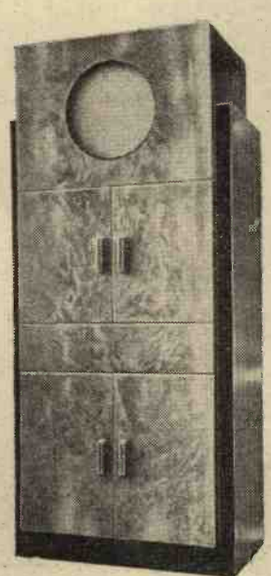
The circuit is fairly conventional, refinements including AVC, visual tuning, and noise suppressor switch. Eight 10in. or 12in. records are dealt with by the automatic record changer, while the cabinet work and layout of the controls follows the usual H.M.V. practice.

The Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.

C.A.C. Austin, showing "post-box" record player.

De luxe version of the Drummer R38.

Drummer (Edge Radio) standard model.



(Above) Dynatron Ether Emperor, with separate short-wave valves.

(Right) H.M.V. Duo-Diffusion Autoradiogram.

(Left) H. M. V. "High - Fidelity" radio - gramophone.

RADIO-GRAMOPHONES: 30 GNS. AND ABOVE (*Continued*)

Alternative Cabinet Designs

HALCYON MODEL 6701G 39 gns.

Six-valve Superhet. Radio Circuit for AC Mains only. Record Changer optional

This is the radio-gramophone version of the Halcyon six-valve nine-stage AC superheterodyne. The power output, however, is increased in this model from 2½ to 5 watts and the loud speaker is inclined to give improved distribution of sound. The Model 6701GE is fitted with additional side cabinets and bookshelves and the price is 47 guineas. Both models may be fitted with an automatic record changer at an additional cost of 8 guineas.

Halcyon Radio, Ltd., Valetta Road, Acton, W.3.

Marconiphone Model 289 with automatic record changer.

Hartley-Turner RGS12 in oak cabinet.

Pye Cambridge radio-gramophone.

Medium- and Short-Range Quality Radio-Gramophones

HARTLEY-TURNER MODEL RGS12 60 gns.

Five-valve "Straight" Radio Circuit for AC Mains only

Designed primarily for high-quality reproduction both of broadcasting and records, this instrument incorporates the Hartley-Turner loud speaker in conjunction with the so-called "boffle" non-resonant mounting. The power output is 12 watts with harmonic distortion less than 5 per cent. and the audio frequency response is claimed to be flat within 1 db. from 40 to 13,000 cycles. The standard oak cabinet costs 60 guineas, but a de luxe cabinet with timber and finish to the customer's own requirements may be obtained for an extra 8 guineas. A whistle ejector may also be supplied for 2 guineas extra.

An instrument of similar specification incorporating the M12 radio chassis with two HF stages is also available at 70 guineas in the standard oak cabinet and 78 guineas in the de luxe cabinet.

Hartley-Turner Radio, Ltd., Thornbury Road, Isleworth, Middlesex.

Marconiphone Model 292, with adjustable selectivity.

"Flexible" Receiving System

HAYNES RADIOGRAMOPHONE £53 5s.

Six-valve "Straight" Receiver for AC Mains

As Haynes receivers are so planned that the user can exercise discrimination in the choice of circuit arrangement, it is not easy to classify them in the usual way.

A typical high-power radio-gramophone outfit consists of a tuner unit comprising 2 HF stages and detector with a total of four circuits (including a band-pass filter), followed by a 6-watt resistance-coupled duophase LF amplifier unit. These units are mounted on a solid wood cabinet, with Haynes Senior speaker and gramophone equipment, at the price given above, but the units and speaker may be obtained separately for £37 5s.

A superhet tuner, or, for short-distance work, a "1-HF" unit, may be substituted. Similarly, output units of lower or higher power may be used. The two units are bolted together, forming a neat chassis.

Haynes Radio, Queensway, Enfield, Middlesex.

All-Wave Universal Model

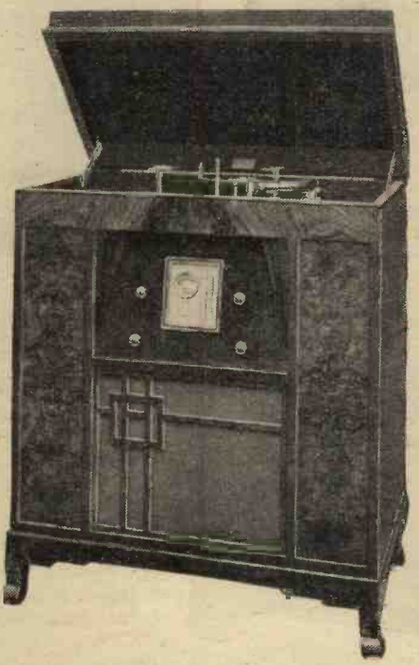
HYVOLTSTAR SUPERHET SEVEN 40 gns.

Universal Six-valve Superheterodyne for AC or DC Mains. Four wave-ranges: 13-27m., 26-53m., 200-550m., 800-2,000m.

This set is similar to the smaller Hyvoltstar model, but employs a more ambitious circuit arrangement and has an even wider wave-range coverage. A signal-frequency HF stage is included, and there is a "silent tuning" device with a visual indicator. Of course, the same universal valves are fitted.

A table radio-gramophone model is produced at 30 guineas.

Universal High-Voltage Radio, Ltd., 28-29, Southampton Street, Strand, London, W.C.2.



Haynes radio-gramophone, obtainable with various chassis assemblies.

Variable Selectivity

MARCONIPHONE MODEL 292 48 gns.

Eight-valve Superheterodyne Radio Circuit for AC Mains only. Automatic Record Changer Standard

This is the leading model in the Marconiphone range of radio-gramophones and is notable for the special elliptical moving-coil loud speaker designed for wide range frequency response and horizontal sound distribution. The radio circuit includes, in addition to quiet AVC, a tone compensated volume control and variable selectivity giving alternative 6 kc/s and 12 kc/s separation. The output stage consists of two push-pull triodes and the power output is 5 watts undistorted.

Duplex Tone Correction

MARCONIPHONE MODEL 291 42 gns.

Six-valve Superheterodyne Radio Circuit for AC Mains only. Automatic Record Changer Standard

The power output of this instrument is 2½ watts, and the moving-coil loud speaker is inclined behind the vertical grille to give good sound distribution. Duplex tone control for correction both of bass and treble and an adjustable noise suppression control will commend this instrument to the discriminating buyer.

Simplified Radio Chassis

MARCONIPHONE MODEL 289 33 gns.

Four-valve Superhet. Radio Circuit for AC Mains only. Automatic Record Changer Standard

This instrument incorporates all the refinements of the foregoing models on the gramophone side, but is equipped with a simpler radio chassis. AVC is, however, included, as well as visual tuning, static suppressor and tone control. The output stage is a single PX4 giving an undistorted output of 2½ watts.

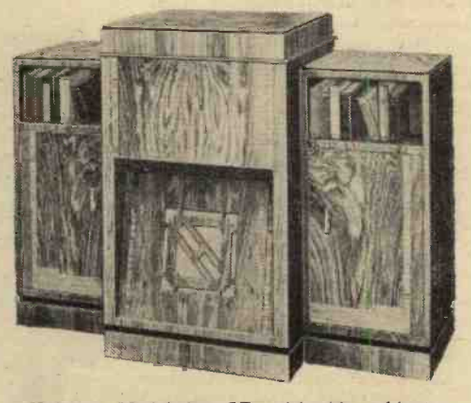
Marconiphone Co., Ltd., Tottenham Court Road, London, W.1.

Novel Speaker System

PYE "CAMBRIDGE" MODEL CR/RG/AC 40 gns.

Five-valve AC Superheterodyne for AC Mains

It is claimed that the special arrangement of loud speakers in this receiver gives high-fidelity reproduction without the necessity for a large grille area in the front of the cabinet. Reproduction of



Halcyon Model 6701GE, with side cabinets and bookshelves.

The valve rating adopted in this Guide does not include the power rectifier

the lower notes is carried out by a cone speaker fitted to an inclined baffle in such a way that sound is projected from under the cabinet. A horn loud speaker, fitted behind a small grille, takes care of the high notes.

Like all Pye sets, this model includes a signal-frequency HF stage and a Westinghouse metal rectifier. Due to the exceptional high-note response, manual tone control is regarded as being of special importance.

A model with automatic record changing is available. Similar sets for DC supplies are also produced.

Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2.

Wide Range Radio Performance

R.G.D. MODEL 1203 130 gns.

Thirteen-valve Superhet. Radio Circuit for AC Mains only. Record Changer Standard

Wavelengths from 15 to 2,000 metres are covered by this instrument, which incorporates every up-to-date refinement in design. In addition to delayed and amplified AVC there is true inter-station noise suppression for which a special valve has been included. The paraphase push-pull output stage delivers 6 watts undistorted.

High-Fidelity Reproduction with Triple Loud Speakers

R.G.D. MODEL 1202 100 gns.

Twelve-valve Superheterodyne Radio Circuit. Automatic Record Changer optional

Although the specification of the radio receiver indicates that the performance will lack nothing in range and selectivity, the primary interest of this receiver is in the steps which have been taken to attain the highest possible quality of reproduction. There are three degrees of selectivity, and with the broadest tuning the circuit is simplified to give the highest possible quality from the local station. There are two cone-type moving-coil loud speakers and a special high-frequency horn designed to extend the frequency response up to 10,000 cycles. A piezo-electric pick-up is used for the reproduction of gramophone records, and an automatic record-changer can be fitted at an extra charge of 7 guineas.

High Selectivity

R.G.D. MODEL 1201 88 gns.

Twelve-valve Superheterodyne Radio Circuit. Automatic Record Changer optional

Incorporating most of the features of the Model 1202, including automatic noise suppression between stations, this model does not, however, include variable selectivity. Twin moving-coil loud speakers are used, and the power output is 6 watts. The equivalent "auto" model costs 95 guineas.

Adjustable High-note Cut-off

R.G.D. MODEL 703 63 gns.

Seven-valve Superheterodyne Radio Circuit. Automatic Record Changer optional

Although omitting several of the refinements of the foregoing models, the receiver in this instrument can be relied upon to give adequate range and selectivity with a powerful output. The audio frequency cut-off is controlled by a three-position switch giving response up to 3,000, 4,000 and 7,000 cycles respectively. Twin loud speakers are employed, and the power output is of the order of 3 watts.

Simplified Cabinet Design

R.G.D. MODEL 700 50 gns.

Seven-valve Superheterodyne Radio Circuit. Automatic Record Changer optional

Although production down to a price is not allowed to influence performance in the slightest degree, the makers have succeeded, by economies in cabinet design and in other directions, in producing in the Model 700 a receiver having a performance comparable with that of the Model 703 at a somewhat lower cost.

Radio Gramophone Development Co., Ltd., 18-20, Frederick Street, Birmingham, 1.

New Ideas in Outward Form

R.I. MODERNE MODEL 38 gns.

Four-valve AC Superheterodyne

The chassis of this model is similar to that of the cheaper R.I. radio-gramophone; the same novel system of valve-operated noise suppression is included.

With regard to externals, the layout is distinctly unusual and appears to be highly practical. The cabinet is of advanced design and contains space for the storage of records, etc. A special loud speaker is fitted.

Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

All-wave Radio Reception

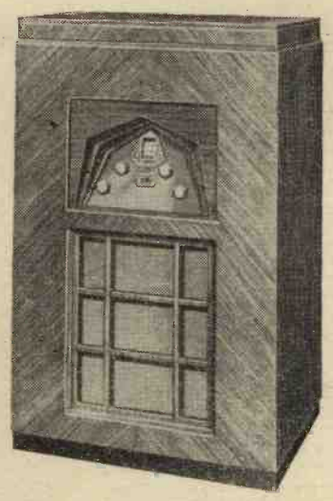
TANNOY RADIOGRAM 65 gns.

Six-valve Superheterodyne Circuit for AC Mains only. Automatic Record Changer Standard

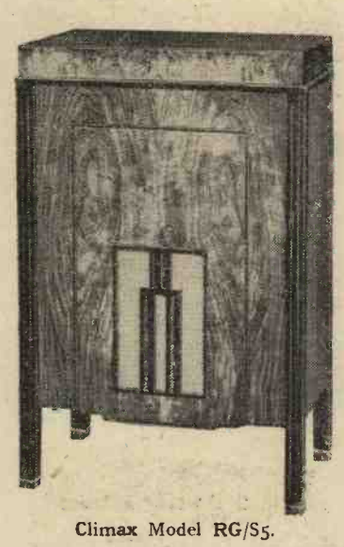
The tuning range is divided into four bands as follows: 13 to 36, 27 to 55, 200 to 550, 800 to 2,000 metres. A signal frequency HF pentode designed to give amplification down to 13 metres precedes the octode frequency-changer, which is followed by an IF amplifier and a double-diode-triode second detector. The volume control between the triode portion of this valve and the output stage is matched to 600 ohms in order that suitable filters may be included to give the highest possible response in the upper register without introducing interference. The standard output chassis gives an undistorted power of 6 watts, but a de luxe model with an undistorted output of 16 watts and a separate loud speaker is available at 95 guineas.

Tannoy Products, Canterbury Grove, West Norwood, S.E.27.

RGD Type 1203 all-wave radio-gramophone.



The smallest radio-gramophone in the RGD range—Type 700.



Climax Model RG/S5.

RADIO-GRAMOPHONES: BELOW 30 GNS.

Good Components in a Low-priced Instrument

AERODYNE "CARDINAL" 20 gns.

Four-valve Superhet. Radio Circuit for AC Mains only. Garrard Pick-up and Motor Unit

There can be no doubt that good value is given in this instrument, for the latest type of circuit is employed with an octode frequency changer, pentode IF, double-diode-triode second detector and pentode output valve. Selectivity is assured by a band-pass input filter, and full AVC is provided.

The gramophone turntable is off-set slightly to the left, and in the space thus provided a Lucerne plan station chart is mounted where it can be conveniently consulted by raising the cabinet lid.

Aerodyne Radio, Ltd., Walthamstow, London, E.17.

Novel Valve Arrangement

AMPLION RADIOLUX RADIOGRAM 21 gns.

Four-valve Superheterodyne for AC Mains

A rather unconventional circuit arrangement in which the usual separate IF valve is replaced by a signal-frequency stage, is included in this instrument. Instead of the usual multiple diode as a second detector and AVC device, there is a power grid detector, AVC voltages being obtained through a pair of Westectors.

Amplion (1932), Ltd., 82-84, Rosoman Street, Rosebery Avenue, London, E.C.1.

HF-det.-LF Circuit

BURTON AC MODEL 17 gns.

Three-valve "Straight" Circuit for AC Mains

This low-priced model is fitted with an HF-det.-LF chassis of straightforward design; a Magnavox speaker is fed with an output of two watts from a pentode valve. The gramophone motor and turntable are of Garrard make.

C. F. and H. Burton, Progress Works, Bernard Street, Walsall.

An Inexpensive Model

CLIMAX RG/S5 18 gns.

Four-valve AC Superheterodyne

The chassis of this instrument is the same as that of the Climax S5 table model receiver. Simplification of the circuit design and consequent avoidance of possible sources of breakdown are important features.

The gramophone equipment is complete, and includes a Collaro induction motor.

Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

"Straight-circuit" Chassis

COSSOR SUPER FERRODYNE MODEL 536 16 gns

Three-valve Circuit for AC Mains

A strong case can be made out for the inclusion of, the simpler type of "straight" circuit in radio-gramophones; this in spite

RADIO-GRAMOPHONES: BELOW 30 GNS. (*Continued*)

of the fact that the superheterodyne circuit is so widely used for the purpose nowadays. Be this as it may, there is no doubt that the Cossor model offers what will generally be considered as an adequate performance at a cost very much lower than that of most superhet models.

The circuit of this instrument is of the HF-det.-LF type, and iron-cored tuning coils are employed throughout. An HF pentode is employed as a detector.

A. C. Cossor, Ltd., Cossor Works, Highbury Grove, London, N.5.

Combined Tone Control and Scratch Filter

FERRANTI LANCASTRIA RADIOGRAM 24 gns.

Three-valve Superhet. Radio Circuit for AC Mains only. Optional Record Changer

Based on the well-known Lancastria receiver, this instrument is housed in a well-proportioned cabinet of modern design. The use of a double-diode-pentode in the output stage combines the functions of second detection, AVC control and power output, and reduces the number of valves to three. The tone control serves also as a scratch filter for the gramophone, and another interesting feature is the combined tuning and indicating dial.

A similar model—the Lancastria Autogram—incorporates a Garrard record changer capable of playing eight 10-inch or 12-inch records consecutively, and is priced at 33 guineas.

Ferranti, Ltd., Hollinwood, Lancs.

Volume the only Exterior Control

G.E.C. RADIOGRAM AVC.5 22 gns.

Four-valve Superhet. Radio Circuit for AC Mains only. Induction Type Gramophone Motor

Essentially the radio circuit is the same as that of the AVC5 receiver and incorporates full AVC, a sensitivity control for tuning in powerful stations only with a quiet background between, and a horizontal tuning scale with coloured indicating dial lamps mounted inside the lid in the motor board. With the lid closed the only accessible control is that of volume.

A large energised loud speaker is fitted, and a silencing key is provided by means of which the internal loud speaker may be cut out of circuit when only the external loud speaker is required.

Special models for 25-cycle or low-voltage AC mains are available at an additional charge of 10s. 6d.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

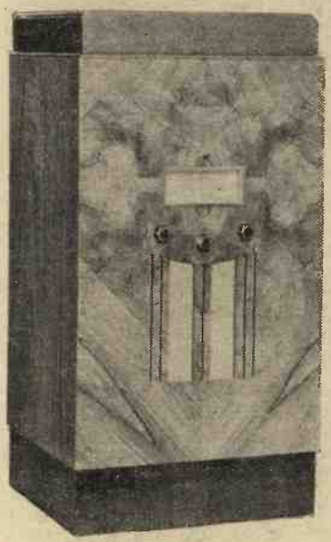
The Smallest H.M.V. Model

H.M.V. SUPERHET FIVE-FORTY RADIOGRAM 20 gns.

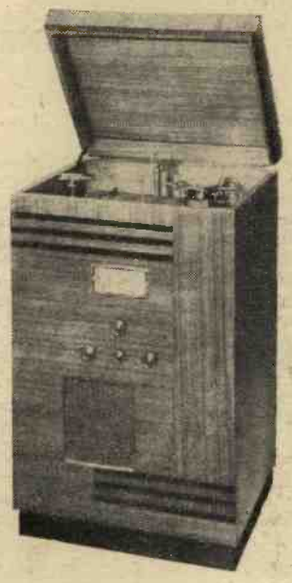
Four-valve AC Superheterodyne

This, the cheapest H.M.V. radio-gramophone, embodies a straightforward superheterodyne chassis with provision for tone control and a pentode output valve rated at 2 watts.

Cossor Super Ferrodyne 536.

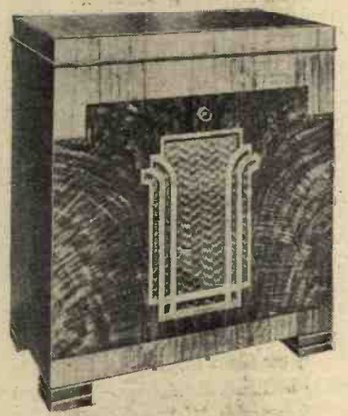


Ferranti Lancastria Radiogram.



H.S.P. Auto-Radiogram RGS5.

H.M.V. Model Five-Forty Radiogram.



G.E.C. Radiogram AVC5.

Hyvoltstar Miniature Radiogram.

Halcyon Model 4501G.

A DC version of the same set costs a guinea extra, while a similar AC instrument, fitted with an automatic changer for eight records, costs 27 guineas.

The Gramophone Co., Ltd., 98/108, Clerkenwell Road, London, E.C.1.

Modern Cabinet Design

H.S.P. MODEL RGS5 27 gns.

Superheterodyne Radio Circuit for AC Mains only. Automatic Record Changer

Of strikingly original design, the cabinet work of this model will meet with the approval of all followers of modern tendencies in decorative art.

An automatic record changer capable of playing eight 10-inch or 12-inch records is a standard item of the specification, and the superheterodyne receiving circuit incorporates AVC and a background noise suppressor switch. The tuning scale is calibrated both in stations and wavelengths.

H. S. P. Wireless Co., Langford Works, Weston-super-Mare.

Incorporating a Mains Filter

HALCYON MODEL 4501G 22 gns.

Four-valve Superhet. Circuit for AC or DC Mains. Tone Control on Radio and Gramophone

The circuit of this instrument is much more ambitious than the number of valves used and the price might lead one to suppose. "Westectors" are used for sound detection and the provision of AVC bias, which is arranged on original lines. The control panel includes a visual tuning indicator. Both volume and tone controls are operative of radio and gramophone reproduction, the tone control being operated by a three-position switch.

The permanently installed anti-interference unit in series with the mains is an unexpected refinement in a set giving such good value for money in other directions. The equivalent model with automatic record changer costs 33 guineas.

Halcyon Radio, Ltd., Valetta Road, Acton, London, W.3.

Solid Cabinet Work

HIGGS MODEL 55TG 26 gns.

Four-valve Superheterodyne Radio Circuit. Separate Models for AC and DC Mains

The chassis incorporated in this radio-gramophone is similar to that of the Model 55T receiver and incorporates the same ingenious oil-damped tuning indicator. Instead of the dual moving-coil loud-speakers, however, there is a single 10-inch unit mounted on a solid baffle inclined in an upward direction to give better distribution of sound. The instrument may be obtained for operation from DC mains at an extra cost of 2 guineas, and a Garrard automatic record charger may be specified at an extra cost of 4 guineas.

Charlton Higgs Radio, Ltd., Westbourne Place, Hove, Sussex.

A Miniature Radio-gramophone

HYVOLTSTAR TABLE RADIOGRAM 15 gns.

Two-valve AC-DC Mains Set with High-voltage Universal Valves

In every respect this model is distinctly unconventional. Ex-

Guide to Receivers—

Subsidiary models, differing so slightly from those enumerated that it is unnecessary to describe them here, are produced by some manufacturers.

ternally, it is probably the most compact radio-gramophone available, while the circuit arrangement is still more unusual.

Only two valves and a Westector are used; the first valve is reflexed, and acts as both H.F. and L.F. amplifier. The second valve is a pentode, rated for an output of 2,500 milliwatts.

An All-wave Universal Model

HYVOLTSTAR TABLE RADIOGRAM 24 gns.

Universal Four-valve Superheterodyne for AC or DC Mains

This model, which covers wavelengths between 19 and 2,000 metres in three steps, is fitted throughout with universal high-voltage valves (operating at full mains voltages) and a Westector acts as a second detector. The first valve is a pentagrid frequency-changer and the output is a high-power pentode. Two Westectors provide rectification and AVC voltages.

With regard to layout, the table radio-gramophone naturally occupies less space than the more conventional form of upright instrument, and has been proved to be a very practical alternative.

Universal High-Voltage Radio, Ltd., 28-29, Southampton Street, Strand, London, W.C.2.

Modern Cabinet Design

KOLSTER-BRANDES KB378 27 gns.

Five-valve Superheterodyne for AC Mains

The chassis of this set is that of the popular KB666 model, which embodies an H.F. stage. The cabinet, of Queensland walnut with chromium-plated fittings, is a striking departure from convention.

An externally similar instrument with a four-valve A.C. chassis is available at 22 guineas, and there is also a battery model at the same price.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

A Popular Model Improved

MARCONIPHONE MODEL Q/286 22 gns.

Four-valve Superheterodyne Radio Circuit for AC Mains only

This instrument is a development of the Lucerne Special Radiogram with the addition of quiet automatic volume control. It follows established Marconiphone practice in having only the volume control on the front of the cabinet, the remaining controls being mounted on the motor board underneath the lid. The "quiet" action of the AVC is controlled by an adjustable static suppressor which can be adjusted to comply with local conditions.

Marconiphone Co., Ltd., Tottenham Court Road, London, W.1.

Non-resonant Reproduction

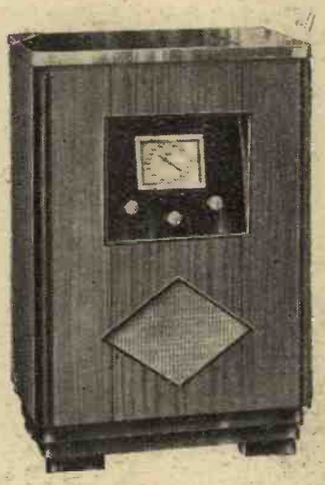
MURPHY RADIO-GRAMOPHONE 24 gns.

Four-valve Superheterodyne Radio Circuit. Separate Models for AC and DC Mains

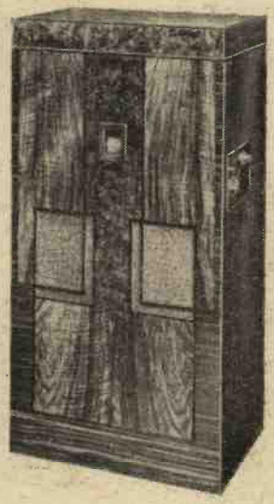
With the radio reproduction safely catered for by the same chassis as is used in the A24 and D24 table models, we can give our undivided attention to the gramophone side. A special high torque motor is provided on a flush fitting motor board. The needle cups are felt-lined to prevent rattle. Special attention has been given to the acoustic design of the cabinet, which is open at the back and is lined with sound-absorbing material. The loud speaker itself is a very different affair from the cheap standard moving coils often fitted in large cabinets. The difficulty of obtaining good high-note reproduction from records without the attendant trouble of needle scratch has been solved by a specially designed filter, and the volume level can be increased without fear of distortion either from a "peaky" top or a "booming" bass.

Murphy Radio, Welwyn Garden City, Herts.

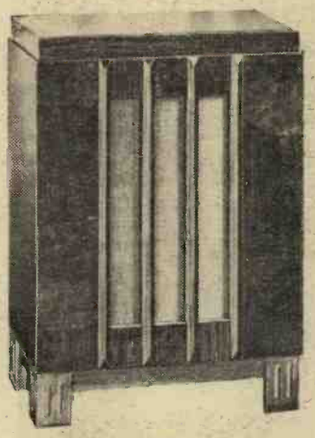
Murphy radio-gramophone.



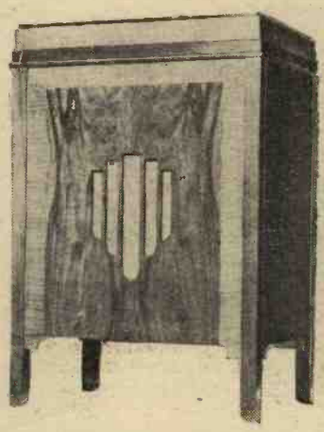
Ultra Model 22.



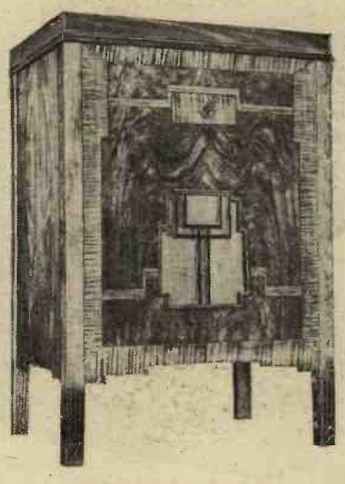
R.I. Ritz with dual speakers.



Pye SE/RG/AC.



Philips Type 538A.



Marconiphone Q/286.

Pentode LF Amplifier

PHILIPS TYPE 538A 23 gns.

Five-valve Superheterodyne for AC Mains

The rather unusual feature of a pentode as an intermediate LF amplifier is embodied in the chassis of this instrument. Tone control and AVC are fitted, and unusual precautions are taken to prevent second-channel interference.

On the gramophone side, a Philips pick-up of new design is used.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

Inexpensive "HF" Superhet

PYE SE/RG/AC 26 gns.

Four-valve Superheterodyne for AC Mains

Although the Pye radio-gramophone chassis embodies the same number of valves as the more conventional set of to-day, there is a radical difference in their sequence. In the present set, an H.F. stage is fitted, but this apparent extravagance is compensated for by using, at the other end of the circuit, a double-diode-pentode for the combined functions of second detector, AVC, and output.

Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2.

Real Noise Suppression

R.I. RITZ DUOTONE 26 gns.

Four-valve AC Superheterodyne

Many so-called noise-suppression systems are in fact nothing more than manually controlled limiters of sensitivity, and cannot fairly be compared with the R.I. method, which is valve-controlled. An extra diode anode in the second detector, which is a triple-diode-triode, is employed for this purpose. The extent of suppression and the initial sensitivity of the set is, however, under the control of the user.

The position of controls seems to be distinctly more convenient than in the average radio-gramophone.

Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

Well-balanced Cabinet Design

ULTRA MODEL 22 20 gns.

Three-valve AC Superheterodyne

The appearance—it is admittedly often nothing more—of top-heaviness that characterises so many radio-gramophones has been entirely avoided in this model; the cabinet is of a particularly well-balanced design, and should be convenient in operation.

By using a double-diode-pentode as a combined second detector, AVC device, and output valve, it has been possible to carry out all the normal functions of a small superheterodyne with only three valves. The Ultra radio-gramophone, in addition to the usual features of its class, embodies tone control and a "clock-face" tuning system. A D.C. model costs 1 guinea extra.

Ultra Electric, Ltd., Erskine Road, Chalk Farm, London, N.W.3.

Guide to Receivers :—

RECEIVERS: 15 GNS. AND ABOVE

Specialised All-wave Design

ALLWAVE INTERNATIONAL SUPERHETERODYNE £35

Universal Six-valve Superheterodyne for AC or DC Mains. Four Wave-ranges: 15–27m., 27–58m., 200–560m. 900–2,000m.

This receiver is designed both for home and overseas use, and accordingly special importance is attached to reception of short waves. It embodies the unusual feature of two IF stages, and the AVC system is designed to combat the effects of high-speed fading, which is particularly apt to affect short-wave reception.

In order to facilitate operation on the short-wave ranges, a two-speed drive is provided for the tuning condenser; this fact, coupled with the special system of calibration (in both metres and kilocycles) should make the set almost as easy to work as an ordinary broadcast set. Another important point is that the manual volume control does not affect the true sensitivity of the set to weak signals.

Allwave International Radio and Television, Ltd., 242, High Street, Bromley, Kent.

Allwave International receiver.

"Straight" Quality Receiver

B.S.R. TYPE R3W 22 gns.

Four-valve "Straight" Receiver for AC Mains Only

Two high-frequency stages with variable-mu pentode valves and band-pass coupling between the stages precede a duo-diode-triode detector which provides delayed and amplified AVC. The output valve is a triode delivering 3 watts undistorted, and a multi-ratio output transformer designed to match loud speakers from 1.5 to 16 ohms is incorporated in the chassis. Ferrocart tuning coils are employed, and a visual tuning indicator is fitted. The makers recommend their Heavy Duty Permanent Magnet Speaker at 5 guineas for use with this receiver. The instrument is available as a radio-gramophone, which, complete with automatic record changer, costs 45 guineas.

Birmingham Sound Reproducers, Ltd., Claremont Street, Old Hill, Staffs.

15 to 2,000 Metres

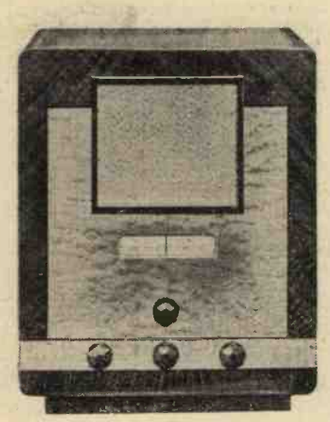
BRITISH RADIOPHONE AWC202 75 gns.

Eight-valve AC Superheterodyne with three Wave-ranges: 15–55 m., 190–560m., 800–2,000 m. Console Cabinet

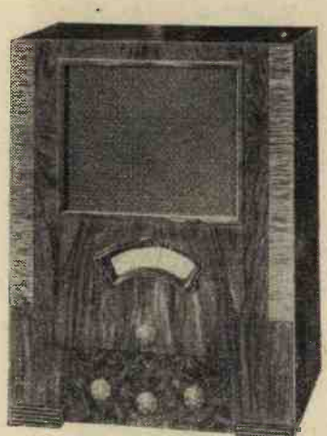
A very ambitious "all-wave" chassis, as fitted in the corresponding radio-gramophone, is used in this model. Special features include an "aeroplane" type of tuning dial with two-speed drive. True QAVC, operated by a separate valve, is included. Coils for all wave-ranges are separately screened and trimmed, thus avoiding interaction.

A slightly simpler model, without the "Q" suppressor valve, and mounted in a table cabinet of the horizontal type, is sold at 45 guineas.

The British Radiophone, Ltd., Aldwych House, Aldwych, London, W.C.2.



Burndept universal AC/DC set.



C.A.C. Austin Battery Super.

Unusual Speaker Mounting

BURNDEPT ETHODYNE SUPERHET 18 gns. (with AVC, 20 gns.)

Four-valve Superheterodyne for AC Mains

Distribution of sound from loud speakers is a subject to which the most careful attention may profitably be paid. In the latest Burndept model the aim is to ensure more equal distribution, and to this end the twin reproducers are mounted at an angle to each other. The system is compared with flood-lighting.

The AVC model is recommended by the makers for long-distance reception or in all districts where signals from even the local station are subject to fading.

A "high-fidelity" model, with a more ambitious circuit with triode output, is sold at 22 guineas.

Transportable for AC or DC

BURNDEPT MODEL 211 15 gns.

Universal Four-valve Superheterodyne for AC or DC Mains, operating on Internal Aerial

Being independent both of the nature of the electrical supply and of an aerial, this type of receiver is particularly convenient. A current-regulating device (a barretter) similarly relieves the user of the necessity for making internal adjustments to suit mains voltage variations between 200 and 250 volts. Variable tone control and a special wave-trap system for eliminating second-channel interference are included.

A similar receiver, with the addition of AVC and an extra valve, is sold at 19 guineas.

Dual-speaker Battery Set

BURNDEPT ETHODYNE BATTERY RECEIVER 22 gns.

Five-valve Battery Superheterodyne

In this model we have what is practically a battery counterpart of the mains-fed Burndept set. It includes the same dual-speaker system, but the circuit is of necessity modified to suit the characteristics of battery valves.

The inclusion of a signal-frequency HF stage should ensure good sensitivity, while at the other end a double pentode, operating in a QPP circuit, feeds the loud speakers.

Burndept, Ltd., Light Gun Factory, Erith, Kent.

BUSH UPRIGHT GRAND 15 gns.

Three-valve Superheterodyne for AC Mains. Console Cabinet

The chassis of the smaller Bush superhet is fitted in a large upright cabinet, and a larger loud speaker than can be usefully employed in most table sets is included. The functions of second detection, AVC, and output are combined in a double-diode-pentode valve, but the circuit is otherwise straightforward.

Self-contained with Aerial

BUSH RADIO SAC7 16 gns.

Five-valve Superheterodyne for AC Mains, operating with built-in Frame Aerial

This completely self-contained receiver employs an HF stage, a Westector as second detector, and a triode valve as an intermediate LF stage. The overall magnification would therefore appear to be exceptionally high, even when compared with other frame aerial sets which naturally require more magnification than more conventional types.

A second Westector provides voltages for the AVC system, which affects three valves—though not to an equal extent. A special circuit arrangement is employed to minimise inter-station noise.

The same chassis is fitted in a chair-side table of unusual design; it operates either with an internal or external aerial and costs 23 guineas.

Bush Radio, Ltd., Woodger Road, Shepherd's Bush, London, W.12.

Avoiding "Side-band Shriek"

C.A.C. AUSTIN AC SUPER 18 gns.

Four-valve Superheterodyne for AC Mains

If distortion is to be avoided, the ordinary superheterodyne must be tuned with extreme accuracy. This limitation to its general usefulness can now be overcome in two ways—by fitting a visual tuning indicator, or by modifying the circuit design in order to avoid the distortion that would otherwise result from slight mistuning. In the Austin receiver the latter plan has been chosen, as precise tuning, still needed with an indicator, is no longer necessary to ensure high quality.

Twin matched loud speakers, seldom found in a small superhet, are fitted, and there is continuously variable tone control.

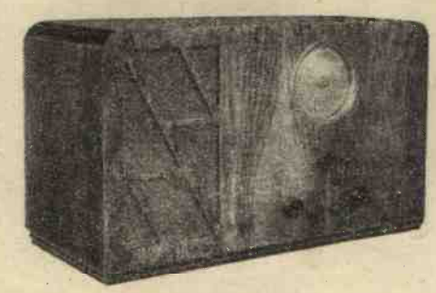
Bias Voltage Compensation

C.A.C. AUSTIN BATTERY SUPERHET 16 gns.

Five-valve Battery Superheterodyne

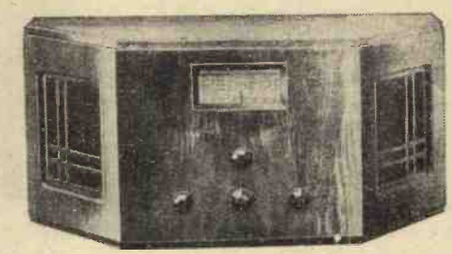
Over-accentuation of high notes as a result of slight mistuning is avoided in this receiver in the same way as in its mains-fed counterpart, which it closely re-

Bush Radio SAC7.

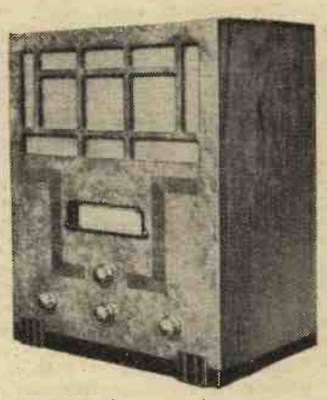


(Left) British Radiophone all-wave receiver.

(Right) Burndept Ethodyne AC superhet.



RECEIVERS: 15 GNS. AND ABOVE (*Continued*)



Edge Radio (Drummer) twin-speaker model.

sembles in essentials. There is, however, a single loud speaker (with a 9in. cone), and the latest type of Class "B" valve is used in the output position.

Excessive grid-bias voltage is a common cause of distortion in battery sets; this is because the bias battery does not deliver current, and so its voltage is maintained longer than that of the HT battery. In the Austin set this source of trouble is avoided by imposing an artificial load on the bias battery, thus ensuring that its voltage will remain "in step" with the HT supply.

City Accumulator Co., Ltd., 18-20, Norman's Buildings, Central Street, London, E.C.1.

New All-wave Set

CLIMAX MODEL 534 16 gns.

Four-valve Superheterodyne for AC Mains. Four Wave-ranges: 12–31 m., 30–80 m., 200–560 m., 800–2,000 m.

This, the latest Climax model, is certainly one of the least expensive of sets offering the attractions of reception of both short and normal wavelengths.

So far as reception on normal wavebands is concerned, the circuit differs little from that of the usual four-valve superheterodyne, but, with an eye to the requirements of short-wave working, special measures have been introduced in the AVC and tone-control systems.

Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

Short and Normal Wavelengths

DRUMMER MODEL M65 17 gns.

Four-valve Superheterodyne for AC Mains. Three Wave-ranges: 20–50m., 200–560m., 900–2,000m.

This is a development of the Drummer M55 model; it includes coverage of an extra waveband, and, in addition, provision of interstation noise suppression.

Iron-cored tuning coils are used throughout in the normal radio-frequency and IF circuits. Automatic volume control is fitted.

Another model, MT75, contains provision for reception of waves between 100 and 200 metres.

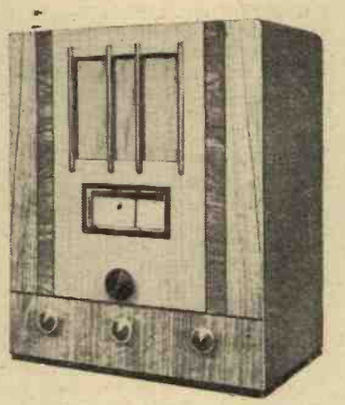
Edge Radio, Ltd., Bolton, Lancs.

An Ingenious Tuning Indicator

DYNATRON MATADOR 19 gns.

Four-valve "Straight" Receiver for AC or Universal Mains Operation

A single HF stage with four



Drummer all-wave receiver.

Ferrocart tuned circuits precedes the detector, and the large-size loud speaker is fed through a single power output valve. The variable neon tuning indicator serves also as a pointer on the circular tuning dial. The standard cabinet is finished in walnut and bird's-eye maple, but a walnut and rosewood cabinet is available at an extra charge of 1 guinea.

Hacker and Sons, Ray Lea Road, Maidenhead.

Specialised Frame-aerial Set

EKCO ADT95 15 gns.

Universal Five-valve Superheterodyne for AC or DC Mains

There is more in the design of a satisfactory mains-operated and self-contained set than the substitution of a frame aerial for the aerial-grid coil of a normal open-aerial receiver. If excessive background noise is to be avoided, special precautions must be taken, and in any case extra sensitivity will be needed. In the Ekco set, "direction-finding" practice is followed, so far as the screening of the long-wave frame is concerned.

The cabinet is of moulded bakelite, and a very sensible station scale of large diameter is fitted.

A battery counterpart of the set is produced at the same price.

E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex.

Superhet with Triode Output

FERRANTI ARCADIA. 15 gns.

Four-valve AC Superhet for External or Mains Aerial

Pentode output valves are almost universal in the less expensive type of receiver, and it is seldom that one encounters a high-power triode in a set costing as little as 15 guineas.

The Arcadia model includes a special system of tone correction, and also fully variable tone control. In addition, it has the attractive tell-tale tuning panel of the smaller Ferranti set.

An Efficient Battery Receiver

FERRANTI BATTERY CONSOLETTE 15 gns.

Five-valve Superheterodyne Circuit with Class "B" Output

The heptode frequency changer in this receiver is preceded by a band-pass input filter, and the single IF stage leads into a duo-diode-triode second detector, which also provides AVC. This is

Ekco frame-aerial set.

H.M.V. Superhet Concert Seven

followed by a driver valve actuating the Class "B" output stage, which is capable of delivering 2 watts undistorted. There is a continuously variable tone control, and the standard Ferranti tuning panel includes a tuning volume indicator.

Portable Battery Superheterodyne

FERRANTI BATTERY PORTABLE 16 gns.

Six-valve Superheterodyne Receiver with Self-contained Frame Aerials

The circuit of this receiver is similar to that of the Battery Consolette, but is fitted with a signal-frequency HF stage. The cabinet is mounted on a ball-bearing turntable. The dimensions are 19½in. × 13½in. × 9½in., and the weight is 56lb.

Incorporating a Synchronous Clock

FERRANTI GLORIA 22 gns.

Six-valve Superheterodyne Circuit for AC Mains Only

The heptode frequency changer is preceded by a pentode HF amplifier, and a single stage of IF amplification is followed by a duo-diode-triode fed into a high-power triode output valve. Fully delayed AVC is provided and a separate valve is devoted to automatic inter-station noise suppression. The synchronous clock, which is fitted as standard, is marked both in the twelve-hour and twenty-four-hour systems for the convenience of those who listen to foreign programmes.

Ferranti, Ltd., Hollinwood, Lancs.

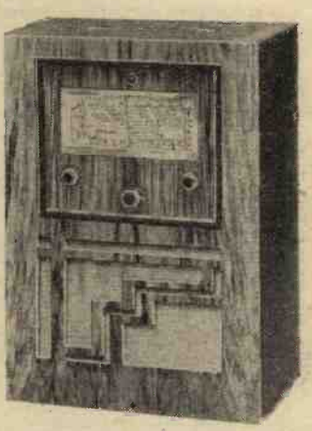
Internal Aerial for Powerful Stations

G.E.C. CONSOLE AVC5 17 gns.

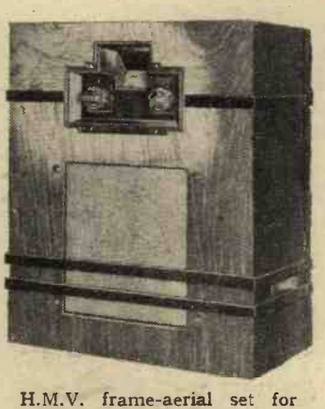
Four-valve Superhet. Receiver for AC Mains Only

With the lid closed the only control requiring the attention of the listener is that of volume, which is placed immediately above the

Ferranti Arcadia.



Ferranti Battery Portable.



H.M.V. frame-aerial set for AC mains.

loud speaker grille. The remaining knobs and the tuning scale are mounted horizontally under the lid. The cabinet is of simple and dignified design, and unsightly external aerial wires may be dispensed with if one is content with the more powerful stations, as a special "wound-up" aerial is incorporated. The circuit is essentially the same as that of the table model AVC5, and the power output is of the order of 3 watts.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Threshold Sensitivity Control

H.M.V. SUPERHET CONCERT SEVEN 17 gns.

Six-valve Superheterodyne; AC and DC models at the same price

A separate oscillator valve, signal-frequency HF stage, and metal rectifiers for second-detec-

RECEIVERS: 15 GNS. AND ABOVE (*Continued*)

tion and AVC purposes are distinctive features of this set. Threshold sensitivity may be adjusted to suit local receiving conditions with regard to electrical interference, etc.

A triode output valve is fitted to the AC model, but for DC supplies a pair of push-pull pentodes are employed; the circuits are otherwise basically similar.

No Aerial Needed

H.M.V. 463AC 16 gns.
Five-valve Superheterodyne for AC Mains with built-in Frame Aerial.

Although we describe self-contained mains sets as "portables" for want of a better word, their real appeal is seldom on the score of portability. Occasionally such sets are moved from room to room—that is a definite advantage of their design—but more often they are used merely to avoid the need for external connections to aerial and earth.

Thanks to continuous technical improvements these sets now have an ample range. The H.M.V. version includes AVC, visual tuning, and is mounted on a turntable so that advantage may be taken of the directional properties of the frame aerial.

A similar battery set costs 15 guineas.

The Gramophone Co., Ltd., 98/108, Clerkenwell Road, London, E.C.1.

Dual Tuning Scales

HALYCON MODEL 6701 19 gns.
Six-valve Superheterodyne for AC Mains only.

Separate tuning scales for medium and long waves appropriately illuminated according to the setting of the wave range switch are an unconventional feature of this receiver. The arrangement of the AVC circuit is another departure from standard practice, and it is claimed that the scheme adopted gives improved reception of weak stations. The horizontal type cabinet is of massive proportions and the loud speaker baffle, which is of special material, is inclined. A console model is available at 22 guineas.

Halcyon Radio, Ltd., Valetta Road, Acton, London, W.3.

Short-Range Quality Receiver

HARTLEY-TURNER MODEL S7 £28 10s.
Five-valve "Straight" Receiver with a Wide LF Response. For AC Mains only

A single HF pentode is preceded by a band-pass filter designed to give a response up to 10 kc/s. This is followed by a tuned HF transformer with reaction, which may be used to narrow the frequency response when interference is present. A power-grid detector, metered to indicate distortion, is followed by a first LF stage feeding a push-pull output stage giving 7½ watts with less than 5 per cent. harmonic distortion. The audio response is said to be flat within 1 db. from 40 to 13,000 cycles. A similar set known as the S12 has an output stage giving 12 watts, and its price is £30 10s. Kits of parts for the construction of the S7 and S12 receivers cost 17 guineas and £19 4s. 6d. respectively, exclusive of valves.

Medium-Range Quality Receiver

HARTLEY-TURNER MODEL M12 39 gns.
Six-valve "Straight" Set for AC Mains only

Two HF pentodes coupled by highly selective circuits are followed by diode rectification and tone compensation in the LF amplifier. AVC is provided, and the power output and frequency response are similar to those of the model S12. Cabinets are supplied to customers' own requirements.

Hartley-Turner Radio, Ltd., Thornbury Road, Isleworth, Middx.

A Modern Unit System

HAYNES RADIO 2-HF: 2½-watt (without Speaker) £30 5s.
Six-valve "Straight" Receiver for AC Mains

The old unit system of receiver assembly, with its untidiness and general air of impracticability, has given way to an improved scheme, retaining all the advantages but none of the drawbacks of the old one. The Haynes system permits the user to choose apparatus suited to his own particular needs and tastes; the component units are then bolted firmly together into a single chassis.

A table-model receiver on this system might consist of a tuner-detector with two automatically controlled HF stages, plus a "duo-phase" push-pull output unit giving 2½ watts. Alternatively, higher power but shorter range would be obtainable with a 1-HF; 6-watt combination. Again, a superhet. tuner might be substituted for the "straight" tuner.

Haynes Radio, Queensway, Enfield, Middlesex.

Dual Loud Speaker Units

HIGGS MODEL 55T 15 gns.
Four-valve superhet. for AC Mains only

An HF pentode precedes the octode frequency-changer which is coupled without amplification through an IF transformer to the second detector. This is resistance-coupled to the pentode output valve, and a separated "Westector" is employed to provide AVC. Apart from the dual loud speakers the most interesting constructional feature of the set is the tuning indicator, which is of the meter type working in a vertical glass cylinder filled with oil.

Charlton Higgs (Radio), Ltd., Westbourne Place, Hove, Sussex.

All-Wave AC-DC Set

HYVOLTSTAR ALL-WAVE SUPERHET. FIVE 18 gns.
Universal Four-valve Superheterodyne for AC or DC Mains. Three wave-ranges: 19–52m., 200–550m., 800–2,000m.

An important point of difference between Hyvoltstar receivers and those of more conventional design is that they are fitted with Ostar-Ganz high-voltage valves, of which the heater elements are designed to operate, like the filament of a lamp, at full mains voltage.

The present model employs a pentagrid frequency-changer and two Westectors, one of which provides AVC voltages. The loud speaker is fed by a pentode rated at 3,500 milliwatts.

Four Wave-ranges

HYVOLTSTAR ALL-WAVE SUPERHET. SEVEN 26 gns.
Universal Six-valve Superhet for AC or DC Mains. Four Wave-ranges: 13–27m., 26–53m., 200–550m., 800–2,000m.

Although basically similar to the smaller Hyvoltstar model, this set is of considerably more ambitious design and covers a wider wave-range. It embodies a signal-frequency HF stage, and the output, provided by pentodes in push-pull, is given as 7,000 milliwatts.

A "silent tuning" device, working in conjunction with a visual indicator, is fitted, and, as the set is wavelength-calibrated on all ranges, tuning should be easy.

Universal High-Voltage Radio, Ltd., 28-29, Southampton Street, Strand, London, W.C.2.

A Quieter Background

KOLSTER-BRANDES KB888 25 gns.
Seven-valve Superheterodyne for AC Mains

This receiver, one of the most ambitious of the K-B range, is fitted with "quiet" AVC, the degree of background noise suppression being manually adjustable. Like all the sets produced by Kolster-Brandes, it is specifically designed for use with a special screened-aerial system, which, with proper care in installation, materially reduces the disturbing effect of electrical interference.

An exceptionally large output for the loud speaker is provided by a pair of pentodes in push-pull.

Variable Selectivity

KOLSTER-BRANDES KB383 19 gns.
Universal Six-valve Superheterodyne for AC or DC Mains. Upright Model 26½in. high

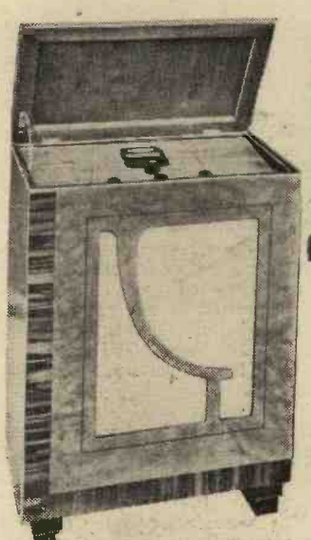
In an imperfect world, the wise man adjusts himself as comfortably as may be to the inevitable. In broadcasting, for example, we all know that high frequencies are necessary for realistic reproduction, but it is comparatively seldom that receiving conditions are good enough for full use to be made of good high-note response in a receiver. With variable selectivity, however, it is possible to make good use of an extended high-note response when conditions are good, and to narrow down the frequency band when interference is present.

In addition to the valuable feature of variable selectivity, this receiver embodies an unusual lay-out. It is so designed that its controls can be conveniently operated when it is standing on the floor. A higher "console" model is also available.

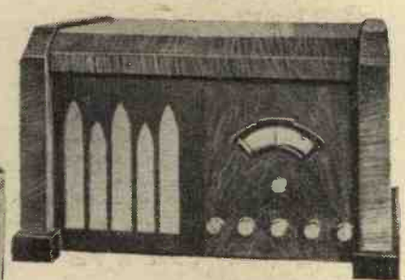
Variable Selectivity Battery Set

KOLSTER-BRANDES KB398 16 gns.
Six-valve Battery Superheterodyne

This is probably the only battery receiver to include the feature of variable selectivity, of which the advantages were discussed in connection with the KB383 model. The basic circuit arrangement in-

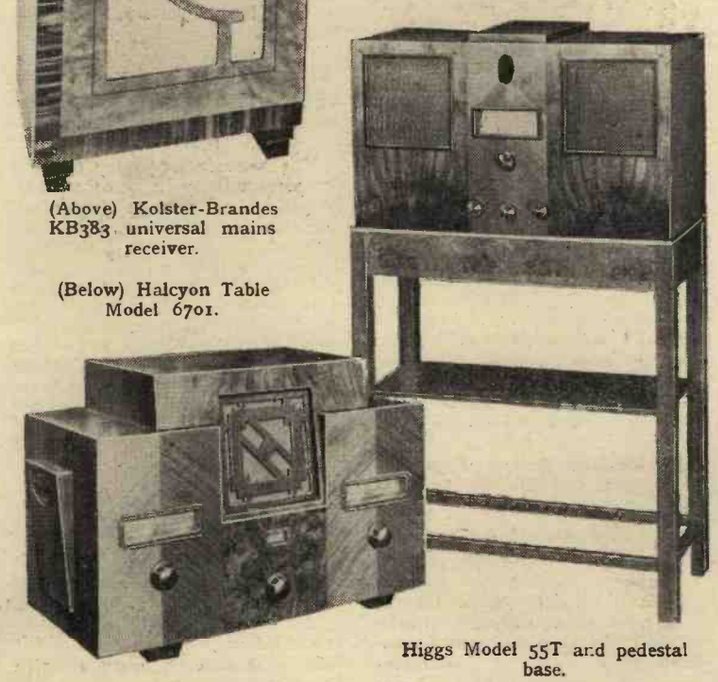


(Above) Kolster-Brandes KB383 universal mains receiver.



Hyvoltstar horizontal model All-wave Superhet. Five.

(Below) Halcyon Table Model 6701.



Higgs Model 55T and pedestal base.

RECEIVERS: 15 GNS. AND ABOVE (*Continued*)

cludes a signal-frequency HF stage and Class "B" output, and, in spite of the relatively ambitious nature of the circuit, HT consumption has been kept within reasonable limits.

"Universal" Mains Transportable Set

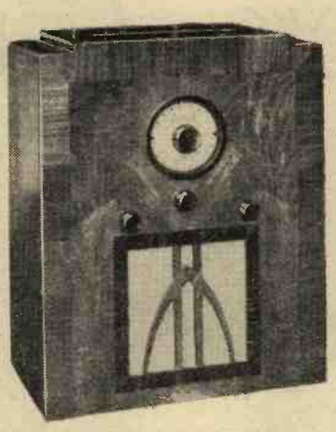
KOLSTER-BRANDES KB405 15 gns.

Universal Five-valve Superheterodyne for AC or DC Mains Operating on Built-in Frame Aerial

As is usual in self-contained frame-aerial sets, the KB405 includes a signal-frequency HF stage, which is a necessary compensation for the loss in sensitivity due to the absence of an outside aerial. From this point onwards, the circuit is, with the exception of a push-pull detector, fairly conventional, and includes a pentagrid frequency-changer and an output pentode.

A set of this type is particularly attractive to those who cannot erect an effective aerial.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.



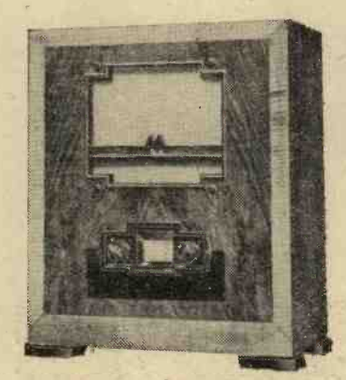
Kolster-Brandes mains transportable.

Self-contained Mains Receiver

MARCONIPHONE MODEL 279 16 gns.

Five-valve Superhet. Receiver with Internal Frame Aerials. For AC Mains only

Admirably adapted for carrying from room to room, this receiver is equipped with an HF amplifying stage before the frequency-changer valve. An external aerial and earth may be attached, but this should only be necessary where extreme range is required. AVC is provided, and should go far to eliminate the directional properties of the frame aerials. The power output is two watts and the energised loud speaker is of new design with a high flux density.



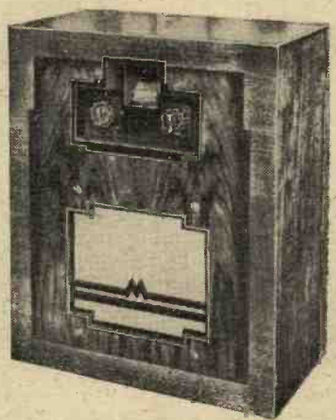
Marconiphone Model 273.

Advanced Battery Receiver Design

MARCONIPHONE MODEL 273 15 gns.

Five-valve Superhet. for Battery Operation

The bare bones of the circuit comprise an HF amplifier, frequency-changer, IF amplifier, double-diode-triode second detector, first LF amplifier and double-pentode output valve. These are amply embellished with a second-channel filter in the input circuit, delayed AVC and a local-distant switch for reducing sensitivity. The QPP output stage gives a peak output of 1½ watts for an average HT current consumption, under normal conditions, of 7.5 mA.



Marconiphone frame aerial set for AC mains.

Range with Economy

MARCONIPHONE MODEL 269 15 gns.

Six-valve Superhet. Battery Portable. Internal Frame Aerials.

A signal-frequency HF stage precedes the frequency-changer, and there is a single IF stage. Diode metal rectifiers are used for second detection, and AVC and a triode LF stage precede the push-pull output pentodes. The latter are arranged on the modified QPP principle known as "parallel conductance," which ensures battery economy without distortion at low volume levels. The loud speaker is of the PM moving-coil type, and there is provision for extra loud speakers as well as a gramophone pick-up.

Marconiphone Co., Ltd., Tottenham Court Road, London, W.1.

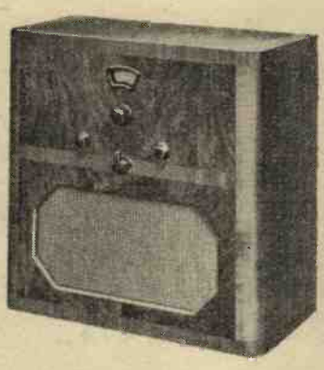
A Famous Portable

McMICHAEL SUITCASE PORTABLE 15 gns.

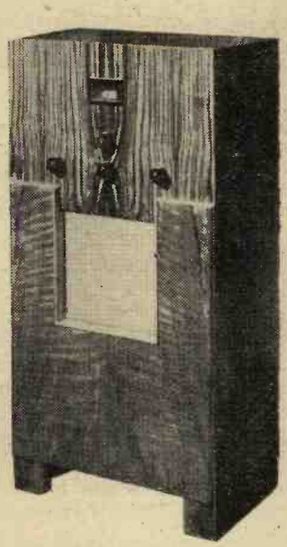
Four-valve "Straight" Battery Receiver operating on built-in Frame Aerial

In a progressive art such as ours, it is hardly to be expected that a receiver should survive year after year. In some respects, the McMichael Portable is no exception to this rule, as the present version bears little resemblance to its original prototype. It does, however, represent a real process of evolution; succeeding models have been gradually modified in accordance with technical progress.

McMichael self-contained AC set.



McMichael Twin Speaker Superhet.



Murphy Console receiver.

The latest set embodies automatic bias, and is fitted with a moving-coil speaker.

Built-in Aerials

McMICHAEL SUPERHET. MAINS TRANSPORTABLE 16 gns.

Five-valve Superheterodyne for AC Mains operating on Frame Aerial

The makers are specialists in self-contained receivers for mains supply. Although battery sets of this type have long been in common use, it is only comparatively recently that mains-fed versions have enjoyed widespread popularity. There can be no doubt that a frame forms the most satisfactory alternative to an outside aerial.

Apart from special features connected with the type of "signal collector" employed, the McMichael set employs a fairly conventional superheterodyne circuit, and, in addition to the usual AVC system, embodies variable tone control.

Twin-speaker Table Model

McMICHAEL TWIN-SPEAKER SUPERHET 18 gns.

Five-valve Superheterodyne for AC Mains

In addition to a pair of matched loud speakers, this receiver includes many circuit refinements, including a relatively ambitious system of noise suppression. Matters are so arranged that the sensitivity in the absence of an incoming signal (and consequently the intensity of background noises) may be set at two different levels, depending on whether one wishes to receive only strong transmissions, or those of any strength within the limitations imposed by the full normal sensitivity of the set.

As in other McMichael sets, HT supply is derived through a Westinghouse metal rectifier.

McMichael Radio, Ltd., Slough, Bucks.

An Acoustically Designed Cabinet

MURPHY CONSOLE RECEIVER £17

Four-valve Superhet. Receiver. Separate Models for AC and DC Mains

The performance of this receiver is identical with that of the A24 table model with the exception of the quality of reproduction, which has been improved in the bass below 100 cycles by the adoption of a large loud speaker with a higher flux density in the gap. The cabinet has been designed primarily from the acoustic standpoint, and its dimensions and lining are proportioned to eliminate "box resonance." At the same time the designers have succeeded in producing what is undoubtedly a very beautiful piece of furniture.

Murphy Radio, Ltd., Welwyn Garden City, Herts.

The Guide to Receivers will be continued in next week's issue, which will deal with the remainder of the "above 15 guineas" class and also with part of the lower-priced categories.

★ ★ Listeners' Guide for

Outstanding

DRAMA WITHIN DRAMA—a hectic moment in "The Show Boat," as performed at Drury Lane. This great musical success is to be broadcast on Monday and Wednesday next, with Edith Day as "Magnolia." Paul Robeson's part of "Joe" will be taken by Ike Hatch.

WHAT WE EXPECT.

"MAGNIFICENT" would have been the verdict ten years ago on the programmes for the next seven days. To-day the verdict is something between a forced smile and a sniff. Perhaps the B.B.C. has fed us too well, with the result that every week is expected to be as good as, if not better than, its predecessor.

Next week's programmes are good, but not outstanding, as we expect them to be, though I would repeat that ten years ago it would all have been magnificent.

◈ ◈ ◈

LINER LAUNCH BY WIRELESS.

NOVELTY breaks through at 10.45 this morning (Friday) with the launching of the Orient liner "Orion" at Barrow-in-Furness by the Duke of Gloucester at Brisbane, Australia. His Royal Highness will press a button which will provide a radio impulse sufficient to set "Orion" in motion down the slipway. As she moves off, a "tripper" will be actuated automatically, breaking a bottle of Empire wine against her bows.

The Duke's speech will be heard by the crowds at Barrow as well as listeners in this country and throughout the Empire, and a running commentary on the whole proceedings will be given by Commander D. A. Stride, R.N. (Ret.), a Freeman of the Honourable Company of Master Mariners.

◈ ◈ ◈

AFOOT IN THE SAHARA.

Is the "Rolling Stones" series spreading a spirit of discontent among the youth of the land? Brian Stuart, the next contributor to the series, will stir the spirit of wanderlust at 9.35 p.m. on Wednesday next, December 12th (Regional), with tales of wandering in the Sahara Desert.

◈ ◈ ◈

TRIBUTE TO A KING.

BELGIUM pays homage to King Leopold III in a concert by the St. Caecilia Choir, augmented Station Orchestra and soloists, relayed by Brussels No. 1, from the Palais des Beaux-Arts, at 8 o'clock on Tuesday, December 11th. The concert will be devoted entirely to Belgian music, which is quite distinctive, though little performed outside its own country.

◈ ◈ ◈

THE WEEK'S OPERA.

OPERATIC programmes this week are many and varied. To-night (Friday), Verdi's Rigoletto is being broadcast at 7.45 from the Rome studio. On Sunday, Paris National offers the operetta "Mlle. Nitouche" by Hervé, at 8 p.m., and later, from 11 p.m. to 1 a.m., Frankfurt and Stuttgart will be giving selections from Wagner's "Parsifal." Monday brings us the opera "Lalla Roukh," by David, from Radio-Paris, at 8 p.m. Wednesday brings a concert version of "La Bohême" (Puccini), from Toulouse, at 9.

"THE SHOW BOAT."

THAT Drury Lane favourite, "The Show Boat," which sailed for 350 performances during 1928 and 1929, is to be broadcast on Monday next, December 10th (National, 8 p.m.) and the following Wednesday (Regional, 8.35 p.m.). Paul Robeson, it will be remembered, took the part of "Joe" and sang the famous "Ol' Man River." This part in the broadcast performance will be taken by Ike Hatch. Edith Day appears with Alberta Hunter, Percy Parsons and Mary O'Farrell.

The play may lose some of its colour in the broadcast version, but not much. The music by Jerome Kern, and the book and lyrics by Oscar Hammerstein, radiofied by Henrik Ege, will force their way over.

◈ ◈ ◈

DR. GOEBBELS.

I SHALL not promise to listen for a solid hour to the special broadcast from Berlin, Funkstunde, to-morrow evening (Saturday, 7.30 to 8.30) in celebration of the Day of National Unity, but I shall tune in for a time, if only to hear the address by the animated Dr. Goebbels. These German orators, whether one understands them or not, have an eloquence which transcends language. The cataract of gutturals alone is a tonic after the soporific sweetness of the Spanish and the Italians.

A GREAT WOMAN CONDUCTOR. Carmen Studer-Weingartner, who conducts Schubert's Unfinished Symphony at Budapest on Tuesday, December 11th, with a concluding movement composed by her husband, the eminent conductor, Felix Weingartner.

the Week

Broadcasts at Home and Abroad

AN ARNOLD BENNETT COMEDY.

"THE GREAT ADVENTURE" is probably Arnold Bennett's best piece of work for the stage; it will be interesting to see whether it "gets over" the ether on Thursday next, when it is to be broadcast by Regional at 8 o'clock.

The late Earl of Oxford (H. H. Asquith), though confessing in his "Letters" that he was "not at all pro-Bennett," wrote ten years ago: "We went to a really good thing last night: Arnold Bennett's 'The Great Adventure' . . . it amuses the whole time, and the two principal parts were quite admirably played by Leslie Faber and Hilda Trevelyan. . . . I was surprised at the excellence of the dialogue."

BERLIOZ NIGHT.

THE works by Berlioz increase in favour year by year. All the French P.T.T. stations are broadcasting his musical drama, "Benvenuto Cellini," at 8.30 p.m. on Tuesday, December 11th. This should be worth the attention of all who have a fondness for orchestral colour effects, at which Berlioz was an adept.

A CROWDED HOUR.

"ENTERTAINMENT HOUR" at 8 o'clock in Thursday's National programme is full of good things. We shall hear Bobby Howes and Binnie Hale on the stage of the London Hippodrome in "What Are We Going to Do?" Earlier in the programme Marius B. Winter and his Dance Orchestra give us "Music Box," No. 11, with songs from the latest shows; Jean Harley and George Barker appear in "Humour and Harmony at the Piano," and at 8.30 comes the second batch of "Dotty Ditties."

JACK HYLTON and his Band make two studio appearances in "Entertainment Hour" to-night (Friday) at 8, on Regional wavelengths, and to-morrow afternoon between 4.15 and 5.15 (National).

Hilda Trevelyan, I am glad to say, is repeating the part of Janet Cannot in the broadcast version, with Harold Scott as the famous artist, Ilam Carve. The play is, of course, founded on the novel, "Buried Alive," and suggests what happens when a corpse's identity is at stake.

EARLY OPERA.

COPENHAGEN is now running an interesting series of broadcasts on the history of opera. At 8.5 p.m. on Thursday, December 13th, the illustrative excerpts will be taken from the works of that early French composer, Lilly, and our own Henry Purcell.

Perhaps the most impressive item is the appearance of Mr. Murgatroyd and Mr. Winterbotham—"two minds with not a single thought."

SIR THOMAS BEECHAM IN MANCHESTER.

SIR THOMAS BEECHAM, conducting the Hallé Orchestra, offers a real treat to London and North Regional listeners at 7.30 p.m. on Thursday next. The concert, which will be given in the Free Trade Hall, Manchester, includes Brahms' "Variations on a Theme by Haydn," Opus 56, and Mozart's E Minor Symphony No. 40.

ST. MARTIN'S - IN - THE FIELDS, viewed from the portico of the National Gallery. The Rev. Pat McCormick is the preacher at the broadcast service on Sunday evening next, at 7.55.

WELSH FROM DROITWICH.

GEORGE BORROW was one of the few Englishmen who ever took the trouble to learn Welsh. However, a knowledge of the language is unnecessary to appreciate the special flavour of the Welsh service to be relayed from the Zoar Congregational Church, Merthyr Tydfil, at 11 o'clock next Sunday morning from Droitwich.

Wales is justly proud of its hymn-singing, which reaches a high standard even in small chapels.

SPANISH NIGHT.

ARE we really getting away from Vienna at last? I greet "Chateau de Madrid" on Wednesday, December 12th (Nat., 7.30 to 8.15 p.m.), as a welcome holiday. This gala night of Spanish song and dance will be inspired by the new Orquesta Hispanica, which is really a Spanish version of Ye Olde "Café Colette."

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, DEC. 7th.

Nat., 7.30, Famous Trials—IV: Court Martial of Admiral John Byng.
London Reg., 8, Jack Hylton and His Band. 9, B.B.C. Chamber Concert, with Conchita Supervia (soprano), Thelma Reiss ('cello), John Ireland (pianoforte).
Abroad.
Prague, 8, Wagner Concert by the Station Orchestra.

SATURDAY, DEC. 8th

Nat., 8.30, "Music Hall."
London Reg., 8.50, Opera "Carmen" (Bizet), Act II, relayed from Sadlers Wells.
Abroad.
Paris (P.T.T.), Symphony Concert by the National Orchestra.

SUNDAY, DEC. 9th.

Nat., 9, Hastings Municipal Orchestra, conducted by Julius Harrison. 10, The Serge Krish Septet.
London Reg., 6.45, Oratorio Programme: The B.B.C. Orchestra (Section E), conducted by Joseph Lewis. Sties Allen (soprano), Margaret MacArthur (contralto), Berkeley Mason (organ). 9.30, B.B.C. Sunday Orchestral Concert, directed by Sir Henry Wood.
Abroad.
Strasbourg, 5, Pasdeloup Concert from the Opéra Comique, Paris.

MONDAY, DEC. 10th.

Nat., 8, Edith Day in "The Show Boat."
London Reg., 7, "The Air-do-Wells." 8, Concert by the B.B.C. Symphony Orchestra (Section E).
Abroad.
Warsaw, 8, Concert by the Chamber Orchestra at the Conservatoire.

TUESDAY, DEC. 11th.

Nat., 8, "The Air-do-Wells." 9, Marie Hall in violin recital of works by Corelli, Haydn, Tastini, Conféria. 10, "The Night Sky," by Dr. Waterfield.
London Reg., 2.5, Oxford *v.* Cambridge Rugby Match at Twickenham: Running Commentary by Capt. H. B. T. Wakelam. 8, "The Great Adventure," a comedy of pre-War London, by Arnold Bennett.
Abroad.
Kalundborg, 9.15, Beethoven Concert.

WEDNESDAY, DEC. 12th.

Nat., 7.30, "Chateau de Madrid," a Gala Night with the Orquesta Hispanica. 8.30, B.B.C. Symphony Concert—V, conducted by Adrian Boult.
London Reg., 8.35, "The Show Boat."
Abroad.
Leipzig, 9.20, "Ulrich von Hutten," for baritone and orchestra.

THURSDAY, DEC. 13th.

Nat., 8, "Entertainment Hour."
London and North Reg., 6.30, "Songs from the Radio Shows." 7.30, Hallé Concert from Manchester, conducted by Sir Thomas Beecham.
Abroad.
Luxembourg, 9.30, German Symphonic Music.

Foundations of Wireless

Part III.—Circuit Elements in Series and Parallel

By A. L. M. SOWERBY, M.Sc.

THE elements of circuits, resistances, inductances and condensers are considered in this instalment, and the effect of various arrangements of these elements in a circuit is dealt with quantitatively, with examples.

(Continued from page 426 of November 23rd issue)

IT is only in the simplest cases that a circuit contains one element alone. A battery lighting a single lamp or a single valve-filament is one of the few practical examples. The circuits usually contain several elements, connected either *in series* or *in parallel*.

Two elements are said to be in series when in tracing out the path of the current we encounter them serially, one after the other. In Fig. 8 (a) the two resistances R1 and R2 are connected in this way. Remembering that an electric current is an electron-flow, it will be evident that *the same current flows through both of them.*

Two elements are said to be in parallel if they are so connected in the circuit that they form two alternative paths for the current flowing between a pair of points. In Fig 9 (a), for example, R1 and R2 are alternative paths for conveying current from A to B. It will be evident, from the nature of things, that the same potential difference exists across both of them.

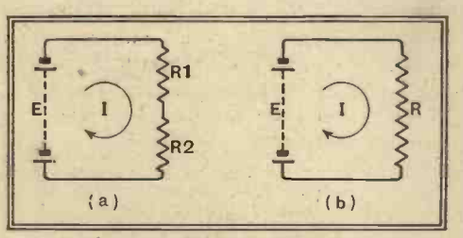


Fig. 8.—Resistances in Series. The circuit (b) is equivalent to the circuit (a), in the sense that both take the same current from the battery E, if $R = R1 + R2$.

It does not follow that because two circuit elements have the same potential difference across them that they are necessarily to be regarded as connected in parallel. If in Fig. 8 (a) R1 and R2 had the same resistance, it would follow, since they both carry the same current, that the potential difference across R1 would be equal to that across R2. In spite of this fact, they are very evidently not connected in parallel; the equality of voltage across them is an accidental result of the particular relative magnitudes we have arbitrarily assigned to them, and not, as in the case of the parallel-connected resistances of Fig. 9 (a), a necessary consequence of their mode of connection into the circuit.

In other words, R1 and R2 of Fig. 8 (a), if of equal resistance, have equal voltages across them, whereas R1 and R2, of Fig. 9 (a), irrespective of their relative magnitudes, have *the same voltage* across them. Rather a fine distinction, perhaps, but a very vital one for the clear understanding of circuits of all kinds. Bearing this point in mind, we can shorten our definitions by saying that:—

"In Series" means *the same current.*

"In Parallel" means *the same voltage.*

Resistances in Series

In Fig. 8 (a) two resistances, R1 and R2, are shown connected in series with one another and with the battery of voltage E. To relate this circuit to the simpler ones already discussed we need to know what single resistance R (Fig. 8 (b)) can be used as a substitute for R1 and R2 taken together.

We know that the current in the circuit is everywhere the same; call it I. Then the potential difference across R1 is IR1, and that across R2 is IR2 (Ohm's Law). The total voltage-drop is the sum of these two, namely $I(R1+R2)$, and is equal to the voltage E of the battery. In the equivalent circuit of Fig. 8 (b), E is equal to IR, and since, to make the circuits truly equivalent, the current must be the same in both for the same battery-voltage, we see that $R = R1 + R2$. Generalising from this result, we conclude that:—

The total resistance of several resistances in series is equal to the sum of their individual resistances.

Resistances in Parallel

Turning to the parallel-connected resistances of Fig. 9 (a), we have the fundamental fact that they have the same voltage across them; in this case the EMF of the battery. Each of these resistances will take a current depending on its own resistance and on the EMF of the battery; the simplest case of Ohm's Law. Calling the currents respectively I1 and I2, we therefore know that $I1 = E/R1$ and $I2 = E/R2$. The total current drawn is the sum of the two: it is $I = E/R1 + E/R2 = E(1/R1 + 1/R2)$. In the equivalent circuit of Fig. 9 (b) the current is E/R, which may also be written $E(1/R)$. Since, for true equivalence between the circuits, the current must be the same for the same battery voltage, we see that $1/R = 1/R1 + 1/R2$. Generalising from this result, we may conclude that:—

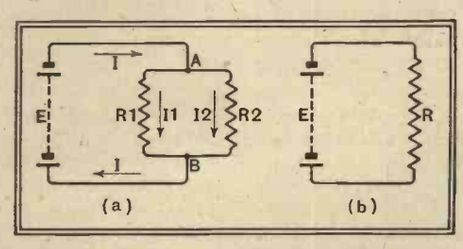
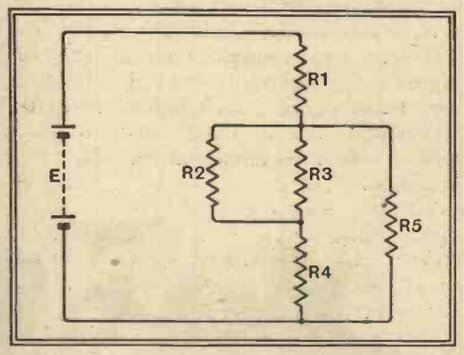


Fig. 9.—Resistances in Parallel. The circuit (b) is equivalent to the circuit (a), in the sense that both take the same current from the battery E, if $1/R = 1/R1 + 1/R2$.



R1=100 ohms, R2=200 ohms, R3=500 ohms, R4=150 ohms, R5=1000 ohms, E=40 volts.

Fig. 10—A complicated network of resistances. The current through and voltage across each can be computed with the aid of the rules already discussed.

If several resistances are connected in parallel the sum of the reciprocals of their individual resistances is equal to the reciprocal of their total resistance.

If the resistances of Fig. 9 (a) were 100 and 200 ohms, the single resistance R that, connected in their place, would draw the same current is given by $1/R = 1/100 + 1/200 = 0.01 + 0.005 = 0.015$. Hence, $R = 1/0.015 = 66.67$ ohms. This could be checked by summing the individual currents through 100 and 200 ohms, and comparing the total with the current taken from the same voltage-source by 66.67 ohms. In both cases the result is 0.015 ampere per volt of battery.

Summing up, we have the two rules which, expressed in symbolic form, are:—

1. Series Connection. $R = R1 + R2 + R3 + R4 + \ldots\ldots$

Foundations of Wireless—

2. Parallel Connection. $1/R = 1/R1 + 1/R2 + 1/R3 + \ldots\ldots$

These rules can be extended to cover quite a complicated network of resistances. In such cases the algebra required, though perfectly simple, is inclined to get very long-winded if an attempt is made to work out a general formula; we will therefore content ourselves with one example, worked out numerically. The example will be the circuit of Fig. 10; we will find the total current flowing, the equivalent resistance of the whole circuit, and the voltage and current of every resistor individually.

Simplification

The bunch R2, R3, R4, R5 is obviously going to be our stumbling-block, so we will begin by simplifying it. In doing this it is always necessary to work from the inside outwards. Writing R23 to symbolise the combined resistance of R2 and R3 taken together, we know that $1/R23 = 1/R2 + 1/R3 = 1/200 + 1/500 = 0.005 + 0.002 = 0.007$. Therefore, $R23 = 1/0.007 = 142.8$ ohms. This gives us the simplified circuit of Fig. 11 (a). If R23 and R4 were one resistance, they and R5 in parallel would make another simple case, so we proceed to combine R23 and R4 to make R234.

$R234 = R23 + R4 = 142.8 + 150 = 292.8$ ohms. Now we have the circuit of Fig. 11 (b). Combining R234 and R5 to make R2345, $1/R2345 = 1/R234 + 1/R5 = 0.00341 + 0.001 = 0.00441$; therefore, $R2345 = 1/0.00441 = 226.5$ ohms. This brings us within sight of the end; Fig 11 (c) shows us that the total resistance of the network now is simply the sum of the two remaining resistances; that is, R of

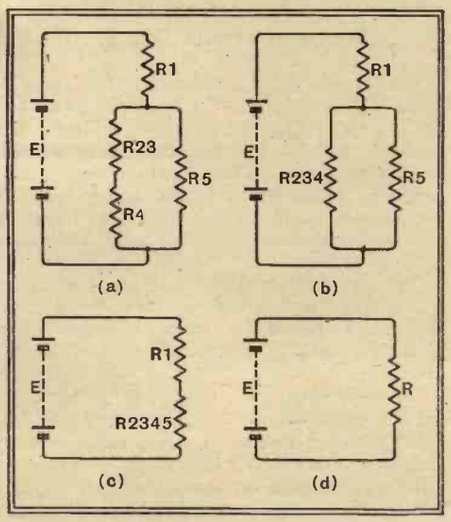
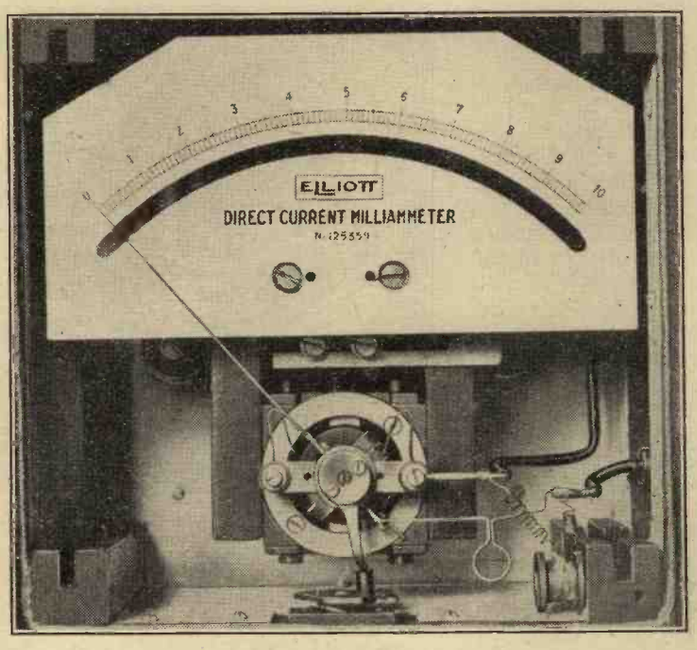


Fig. 11.—Successive stages in simplifying the circuit of Fig. 10. R23 stands for the single resistances equivalent to R2 and R3; R234 to that equivalent to R2, R3 and R4, and so on. R represents the whole system.

Fig. 11 (d) is $R2345 + R1 = 226.5 + 100 = 326.5$ ohms. From the point of view of current drawn from the 40-volt source the whole system of Fig. 10 is equivalent to a single resistance of this value. The current taken from the battery will therefore be $40/326.5 = 0.1225$ amp. $= 122.5$ milliamps.

To find the current through each resistor individually now merely means the application of Ohm's law to some of our previous results. Since R1 carries the whole current of 122.5 mA, the potential difference across it will be $100 \times 0.1225 = 12.25$ volts. R2345 also carries the whole current (11c); the pd across it will again be the product of resistance and current, in this case $226.5 \times 0.1225 = 27.75$ volts. This same voltage also exists, as comparison of the various diagrams will show, across the whole complex system R2 R3 R4 R5 in Fig. 10. Across R5 there lies the whole of this voltage; the current through this resistor will therefore be $27.75/1000$ amp. $= 27.75$ mA.



Milliammeter with front removed. The coil lies behind the pivot between the poles of the magnet. When moved by a current it sweeps the pointer over the scale.

The same pd across R234 of Fig. 11 (b), or across the system R2 R3 R4 of Fig. 10, will drive a current of $27.75/292.8 = 94.75$ mA. through this branch. The whole of this flows through R4 (11a), the voltage across which will accordingly be $150 \times 0.09475 = 14.21$ v. Similarly, the pd across R23 in Fig. 11 (a), or across both R2 and R3 in Fig. 10, will be $0.09475 \times 142.8 = 13.54$ volts, from which we find that the currents through R2 and R3 will be respectively $13.54/200$ and $13.54/500$ amp., or 67.68 and 27.07 milliamps, making up the required total of 94.75 milliamps for this branch.

This gives a complete analysis of the entire circuit; we can now collect our scattered results in the form of the following table:—

RESULTS OF SOLVING FIG. 10.

Resistance.	Current (milliamps.).	Voltage (volts).	Power (watts).
R1	122.5	12.25	1.501
R2	67.68	13.34	0.916
R3	27.07	13.54	0.367
R4	94.75	14.21	1.346
R5	27.75	27.75	0.771

A resistance is rated on the basis of the opposition it offers to the flow of current, while an inductance is rated on the basis of the opposition it offers to a *change* in that flow. Two inductances in series, like two resistances, will evidently offer a greater opposition than one, while if two are placed in parallel, thus providing alternative paths for the current, the opposition offered by them jointly will be less than that of either alone. We will therefore jump to the conclusion that inductances and resistances obey the same laws, in the sense that they must be combined in the same way, and will enunciate the rules:

(1) The total inductance of several inductances in series is equal to the sum of their individual inductances, and

(2) If several inductances are connected in parallel, the sum of the reciprocals of their individual inductances is equal to the reciprocal of their total inductance. In symbols:—

Series Connection: $L = L1 + L2 + L3 + \ldots$

Parallel Connection:

$$1/L = 1/L1 + 1/L2 + 1/L3 + \ldots$$

We shall meet more convincing proof of the truth of these rules when we come to consider alternating currents.

Condensers

The larger the capacity of a condenser the greater the quantity of electricity required to charge it to a given voltage. Note the contrast: more ohms or more henrys connote *less* current, whereas more farads connote *more* current.

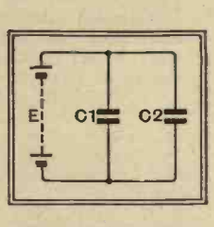


Fig. 12.—Condensers in parallel. Each condenser takes its own charging-current without respect to the other. Since condensers are rated by their charging-current, the capacity equal to these two in parallel is given by $C = C1 + C2$.

Take, for example, the circuit of Fig. 12, where $C1 = 1\mu F.$, $C2 = 2\mu F$. The charging currents flowing into the two condensers are quite independent; when the current stops, each condenser has accepted the quantity of electricity necessary to charge it to the voltage of the battery. One microcoulomb into C1, and two into C2, for each volt of the battery; total, 3 microcoulombs per volt, which, by the definition of capacity, is the amount required to charge $3\mu F$. Evi-

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dently, the total capacity of C1 and C2 taken together is the sum of the separate capacities, and we may formulate the rule:

If several condensers are connected in parallel, they make up a total capacity equal to the sum of their individual capacities.

$$C = C1 + C2 + C3 + \ldots\ldots$$

Observe that the rule for condensers *in parallel* has the same form as that for resistances or inductances *in series*.

Now let us consider the same two condensers connected in series, as in Fig. 13. Owing to the insulation between the two pairs of plates, the portion of the system including the upper plate of C2 and the lower plate of C1 is completely isolated from the rest of the circuit. In consequence, every electron entering the upper plate of C2 must involve the loss of one electron from the lower plate of C1; that is, the same individual quantity of electricity charges both condensers.

The voltage to which each condenser is charged by this quantity of electricity Q depends on its capacity; by the definition of capacity, $V1 = Q/C1$ and $V2 = Q/C2$. In the same way, the capacity C, which, if connected across E, would take the same quantity of electricity to charge it, is given by $C = Q/E$. Since the two voltages V1 and V2 together make up E, $C = Q/(V1 + V2)$. Putting in place of V1 and V2 their equivalents $Q/C1$ and $Q/C2$, we get $C = Q/(Q/C1 + Q/C2) = 1/(1/C1 + 1/C2)$, whence $1/C = 1/C1 + 1/C2$.

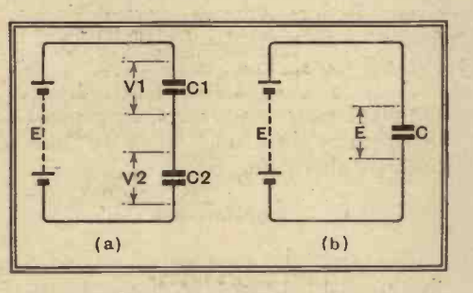


Fig. 13.—Condensers in Series. The voltage E is divided between the condensers; hence each takes less charging-current than if it were directly connected across E. For the same charging-current in the two circuits, $1/C = 1/C1 + 1/C2$.

This is our old friend the "reciprocal law" arrived at in a new way, and we conclude that:

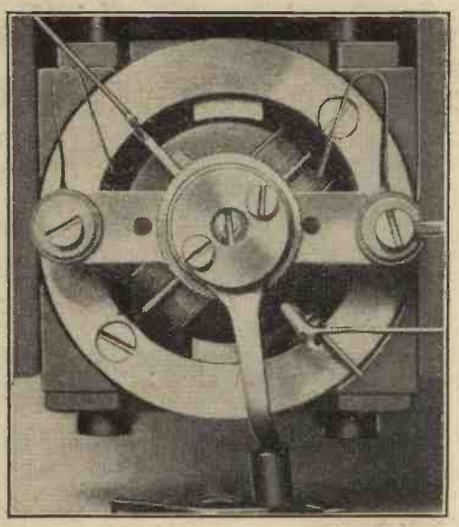
If several condensers are connected in series, the sum of the reciprocals of their separate capacities is equal to the reciprocal of their total capacity.

The rule for condensers *in series* thus has the same form as that for inductances or resistances *in parallel*.

Measuring Instruments

Although much has been said of current, voltage, and resistance, the methods of measuring these have not been discussed. In everyday practice, as distinct from laboratory work, current only is measured, using for this purpose an *ammeter* or *milliammeter*.

This consists of an instrument in which the current to be measured is caused to pass through a coil of wire suspended on light bearings between the poles of a permanent magnet (see illustrations). The magnetic field set up by the passage of the current through the coil is acted upon by the field of the magnet, the two being so disposed that the resulting mechanical force tends to rotate the coil. Except for the restoring torque of a light spring, this is free to turn, carrying with it a pointer which moves across a scale calibrated in amperes or milliamperes.



Enlarged view of pivot of milliammeter. The coil can be seen here; it moves at right-angles to the pointer. Note balancing weight on the latter.

In order that the current in a circuit may not be appreciably altered when the meter is inserted to read it, an ammeter or milliammeter always has a low resistance.

A *voltmeter*, which is scaled to read volts directly, is in reality a milliammeter in series with a fixed resistance of high value. If scaled in milliamperes, all readings would have to be multiplied by the value of this resistance (since $E = IR$) to find the corresponding voltages; in a proper voltmeter this multiplication is done once and for all by the maker of the instrument when he engraves the scale, which therefore reads volts directly.

Although very much better methods exist, and are used in laboratory work, it is usual to measure resistance in everyday wireless practice by observing independently the current through, and the voltage across, the resistance to be measured. Ohm's Law then gives the resistance by simple division of voltage by current.

The Diary of an Ordinary Listener

A SOMEWHAT uneventful week in which small trials and disappointments have seemed too prevalent. More than once, when I picked out an inviting programme and had settled down to enjoy it, some unwanted station butted in and marred reception. However, on calmer reflection, perhaps things were not so bad as I thought.

On November 22nd I turned first to Copenhagen for the accustomed Thursday concert by the Radio Symphony Orchestra conducted by Fritz Busch, and heard a spirited performance of Brahms' Second Symphony in D and 'cello solos by Cassado, who began with an adagio by Bach and followed this with his own arrangement of an allegretto by Schubert.

On Friday evening the usually safe and reliable Berlin Funkstunde seemed rather spasmodic, and as I was unable to get satisfactory reception of Beethoven's Second Symphony I went on to Strasbourg, where the orchestra was playing waltz music, apparently in one of the intervals between the plays which constituted the station's advertised programme.

Searching around somewhat casually I came in for part of a concert by the small station orchestra from Munich, and heard that familiar song "The Rosary" sung by a contralto with a voice of such depth and power that I mistook it at first for a light tenor.

Saturday proved an unlucky day for me. I had settled down comfortably to enjoy the Beethoven concert by the Basle Music Society, conducted by Weingartner, which was being relayed from Beromünster, when, in the middle of the 4th Symphony, Athlone began to intrude, and I found it practically impossible to get it quite clear. I then went over to Cologne for a Bach programme by Prof. Hans Bachem, but here again I encountered a very perceptible background from North Regional.

Monday was rather a short evening as far as my own listening was concerned, but I heard Chopin's Polonaise in A flat played very clearly and crisply by Herr Grundeis at Leipzig, and then found Juan-les-Pins coming in without any interference and transmitting a gramophone record of the Toreador's song from "Carmen." Going over to Milan I came in for some more records, including several of Caruso's famous songs, notably "O Sole Mio."

When Journals Disagree

On Tuesday I turned first to Vienna to hear Weber's opera, "Euryanthe," by the State Opera Choir and the Symphony Orchestra, picking up the concluding portion of the first act. Then, feeling that I had neglected Luxembourg for some time, I switched over to that station and found it coming in clearly and well with a concert of light music.

The news interval followed, so I went on to Berlin, wondering what sort of programme I should find there, as none of the three journals I consulted agreed. Fearing that I should find myself in the midst of a lengthy discourse, I was agreeably surprised to discover the orchestra playing most pleasing music. Later I went over to Cologne for a number of waltzes by Dvorak, admirably played on the pianoforte, though these were slightly marred by a background of "Wuthering Heights" from North Regional, which did not make a very happy blend.

From Brussels No. 1 I heard the Symphony Orchestra and M. Carael in Mozart's "Horn Concerto" in E flat, after which I settled down to Radio-Paris for the remainder of the evening, renewing old and almost forgotten memories of the tuneful music of "Les Cloches de Corneville."

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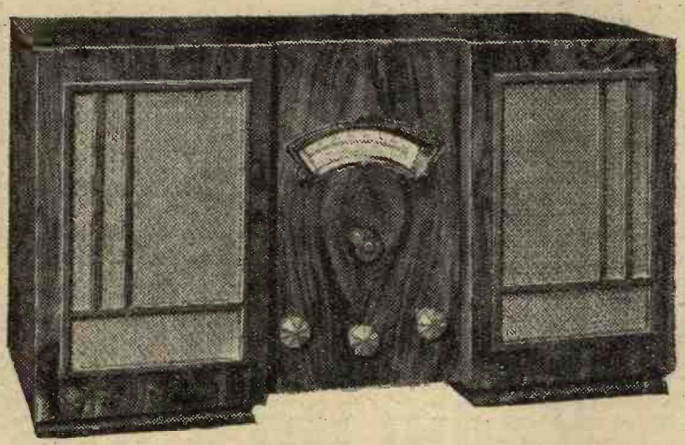

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"The Wireless World" Test Reports, March 2nd and August 3rd, 1934, emphasized the "High Overall Efficiency" and "The Outstanding Quality" of Austin Receivers.

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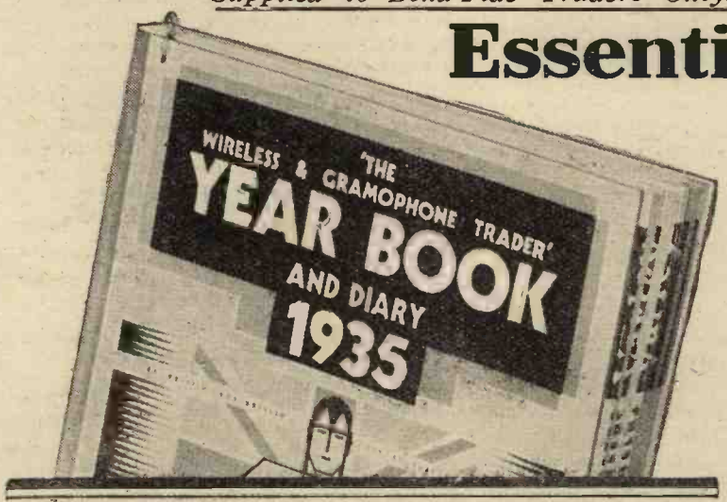

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New Valves for Old Receivers

Further Points to Consider When Replacing Obsolete Valves

By F. E. HENDERSON

CONTINUING his subject from last week the author discusses the replacement of obsolete LF valves by modern types and refers also to the employment of pentodes, both HF and LF, to improve performance of old sets.

IT is on the audio-frequency side that there is special scope for improving old sets by substituting new valves, for advantage can then most frequently be taken of improved mutual conductance. This improvement takes one of two forms—either higher amplification factor or lower impedance. The former case results in a shorter grid base for a given HT voltage, thus necessitating a reduction of the applied negative grid bias. Having revised the bias, the effect of such a change is to increase the sensitivity to weak signals, but increased control of the stronger signals becomes necessary to avoid over-modulation and distortion.

If a valve of higher mutual conductance is chosen on account of its lower impedance value, the effect in an output stage is to increase the *potential* power output.

In some cases an audible improvement in this may be accomplished without modification of the circuit, but it is preferable to adjust the output load resistance to suit the optimum figure for the valve by means of a suitable transformer or choke.

Very often—particularly in receivers of older design—the decoupling provided is inadequate to prevent feed-back when the stage gain is increased, and in many cases no decoupling at all was necessary with the older low-efficiency valves. Insufficient or badly arranged decoupling results in audio-frequency oscillation, or "motor-boating," and this factor should be taken into consideration in making any increase to the amplification by the introduction of new valves. The table below gives a comparison of maximum voltage amplification and power output, showing the differences in these respects between old type and modern valves of comparable classes.

In replacing a valve of one type with one of another it seldom happens that a simple interchange of valves can be effected without any modification to supply voltages, and particularly is this the case with LF amplifying or power valves. The non-technical user is liable to be misled by advertisements extolling increased amplification by the introduction of this and that new valve and to forget that any triode valve to give greater *voltage amplification*, or higher "amplification factor," can only do so by reason of a closer grid control. (Increased amplification in a screen-grid tetrode or pentode valve is mainly a function of the mutual conductance, and in such cases "amplification factor" has little or no practical meaning.) Higher "amplification factor" involves a shorter grid base, and hence the replacement of an LF or power triode by another of a higher factor means a reduction in the grid bias, or anode current distortion will result.

Type.	Grid Bias at Max. HT volts.	Approx. Power Output, Milliwatts.
P215	— 9	150
LP2	— 4½	300
LS5A	—112	2,500
PX25	— 31	5,500

Should the replacement of a screen-grid HF valve be under consideration, the introduction of a variable-mu type may be well worth while as permitting an easy and efficient means of volume control. The grid-bias volume control method may be applied in addition to any other method already in use with the original valve, and is likely to produce a valuable improvement in these days of "more and higher-powered" stations.

(Concluded from page 433 of last week's issue)

The VMP4K, an HF screen pentode with interelectrode capacity as low as the best screen-grid tetrode.

In the case of battery-operated sets the HT current feed is one of the most important considerations, and by a careful study of valve characteristics it is often possible to economise in the current drain compatible with a certain standard of amplification in the HF stages. Here, again, the introduction of a variable-mu valve is of benefit in that the HT current taken is very small when biased to such a negative grid voltage as will reduce the volume sufficiently for local-station reception, and an economy is effected.

The reverse state of affairs exists at the low-frequency end of the set, where any improvement designed to benefit power output will increase the anode-feed current and must be considered in conjunction with the nature of the HT—whether battery or mains-rectifier equipment—as any such increase in power must necessarily involve either larger-capacity batteries or a more generous rectifier output.

Grid-Current Characteristics

Under the heading of grid-current characteristics should be included the forward and reverse currents taken by the control grid and also the currents taken by any other grid, such as the "screen" grid of a tetrode.

Fortunately, with modern hard valves correctly used, the variation in reverse grid current which indicates softness of vacuum need not seriously enter into the picture, and seldom does the question of positive grid current affect the position as regards replacement valves. It should, however, be noted that with large power valves a total resistance in the grid circuit of more than 250,000 ohms is not recommended, this resistance to include grid leak, any HF blocking, decoupling, etc.

The screen-grid current in tetrodes and pentodes is important as its value will affect the actual voltage applied to the screen grid. It might thus be quite

COMPARISON OF CHARACTERISTICS—OLD AND NEW TYPES

Class	Type	Amplification Factor	Impedance	Optimum Load Resistance	Overall Voltage Magnification	Approximate Power Output (at 150 volts)
			ohms.	ohms.		
Detector Valves	DER	9	32,000	60,000	6	—
	HL210	24	20,000	40,000	16	—
	HL2	27	18,000	40,000	19	—
Detector Valves	MH4	40	11,000	30,000	30	—
	MH41	80	13,300	30,000	55	—
LF Valves	L210	11	12,000	24,000	7.5	—
	L21	16	8,900	18,000	10.5	—
Output Valves	DE6	5.5	10,000	20,000	—	100 milliwatts
	P215	7	5,000	10,000	—	150 ,,
	P2	7.5	2,150	4,500	—	300 ,,

feasible to obtain poorer results from a replacement valve even though of higher efficiency, simply because its screen current being higher than that of the original valve, a lower actual screen voltage is obtained, thus restricting the input and magnification. The remedy is to adjust the values of resistance in the screen grid feed circuit to those recommended by the makers.

Interelectrode capacity is an exceedingly important characteristic which has marked effects on receiver performance, more particularly in receivers incorporating ganged circuits. When substituting valves in sets in which the tuned circuits are ganged, therefore, it is essential that some attention should be paid to the trimming condensers if the anticipated improvement is to be realised. Different types of valve vary considerably in capacity—from about 0.002 mmf. to 0.01 mmf. for the anode-grid capacity in screen grid valves, and from 3 mmf. to over 14 mmf. for triodes. The high values present with certain power triodes call for precautions in the grid circuit to prevent distortion caused by spurious oscillation. Introduction of a series resistance in the grid-filament circuit, or across the inter-valve transformer secondary, is helpful in enabling full advantage to be taken of improved valves.

Pentodes

It is a common belief that the introduction of an HF pentode in place of a screen grid tetrode will result in considerable benefit in HF gain, and in certain cases this may be so. Such a step, however, should not be taken without due consideration for other constants in the circuit.

For instance, it may be that the anode-grid capacity of the pentode in combination with a high value of mutual conductance will introduce such feed-back in a circuit as to render the whole HF amplifier unstable. Some HF pentode valves show an anode-grid capacity very much in excess of the screen grid tetrodes, and thus necessitate the use of tapped tuning coils if stability is to be maintained and selectivity not spoiled. Later types, an example of which is the VMP4K type (illustrated on the previous page), have an interelectrode capacity as low as a screen grid tetrode, and these valves can usually be employed in place of tetrodes with improved gain providing suitable tuning coils of high dynamic impedance are used to take advantage of the pentode characteristic.

Another point to bear in mind is, of course, the difference in the pin arrangement; most HF pentodes bearing a seven-pin base which enables the metallised coating to be earthed, and thus a change is necessitated in the type of valve holder and the wiring of this.

A third point to bear in mind is that the resistance network suitable for an original screen grid valve in a set is not necessarily applicable to the HF pentode, and the manufacturers' instructions should be carefully followed in such cases.

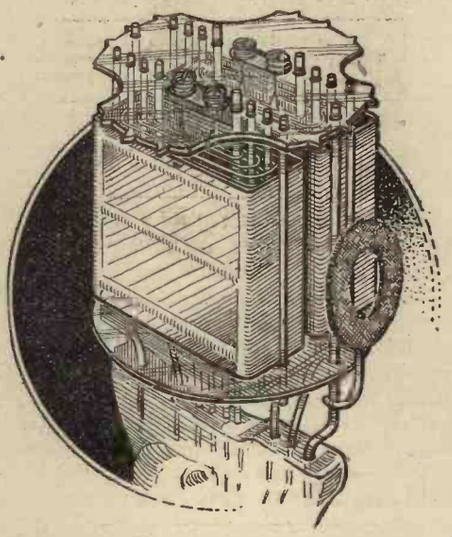
The introduction of an HF pentode to the detector stage is also often worth consideration as tending to improve both the selectivity and the sensitivity of the receiver.

The Output Stage

Many users wishing to increase the sensitivity of a receiver are desirous of changing the output valve, if a triode, for one of the pentode class. While this modification will undoubtedly result in an increase in magnification, certain precautions are necessary if quality is to be maintained.

For instance, it is never advisable to adopt such a change if the LF amplifier employs an intermediate stage of amplification between the output and the detector. The use of pentodes should be restricted to sets with a single stage of LF only. Secondly, it is extremely important to make certain that the correct matching is employed between the pentode and loud speaker by means of a suitable transformer. In the third place a filter to prevent undue amplification of the higher frequencies is essential, and this usually takes the form of a condenser and resistance in series across either the output transformer primary or the grid filament circuit of the pentode.

When employing pentodes it is also advisable to use as high a value of HT voltage as permissible, as the quality of reproduction deteriorates with a falling voltage on the pentode to a greater extent than is noticeable with a triode.



The QP21, a double pentode, which with proper precautions, can be used for the final stage as a class "B" output.

In addition to the simple changes of valves which have been outlined above, together with the precautions to be observed before any such change can be adopted, there are, of course, more complicated modifications which can be attempted by the more experienced reader. Thus it is sometimes possible in battery sets to introduce a Class "B" output stage in place of that hitherto employed. The double pentode of the QP21 type facilitates this owing to the fact that no driver stage is required, and all that is necessary is to modify the output valve circuit and introduce the correct push-pull transformers.

It need hardly be said that in mains-driven sets no such modification of the output stage is desirable unless the whole rectifier circuit is taken into consideration at the same time.

In considering the re-valving of an AC mains set it is important that the rectifier valve should not be neglected. This valve is the source of power to the set, and is normally operating under even more severe conditions than any of the amplifying valves. A good plan, therefore, is to see that the rectifier is replaced at regular intervals, and in this case there need be no hesitation in utilising the same class of valve again—here it is helpful that rectifiers have fortunately been more or less standardised between various valve manufacturers.

Space does not permit of further discussion on the mechanical developments which have taken place in valves, but modifications in mechanical technique over the past few years would alone justify the re-valving of an old-type receiver by a reduction in the chances of microphonic noise and background interference, and by introducing a general improvement in robustness and reliability to the whole set.

THE RADIO INDUSTRY

A BROADSHEET showing the appropriate Rola extension speakers for use with most well-known receivers has just been issued by the British Rola Co., Ltd., Minerva Road, Park Royal, London, N.W.10.

Baker's Selhurst Radio, Ltd., are about to produce a synchronous electric clock which will be mounted in a bakelite cabinet to match the Fydelitone loud speaker. The price will be 29s. 6d.

It will hardly be news to most readers that valve manufacture is an increasingly important part of the Ferranti activities. The new valve list just introduced by the firm is an exceptionally useful publication containing as it does characteristics, typical circuits and base connections for each type. Copies are obtainable from Hollinwood, Lancs.

Henry Ford Radio, of 56, Howland Street, Tottenham Court Road, London, W.1, are suppliers of American valves, and have just issued a list describing the principal types in stock.

As stated recently in this column, the Radio Development Company, of Aldwych House, Aldwych, London, W.C.2, have taken over the manufacture and distribution of Epoch loud speakers. A catalogue has just been issued.

A preparation sold under the trade name of "Non-resona" has just been introduced by Radio Acoustics Company, 15, Pembroke Road, Walthamstow, London, E.17. It is claimed that the substance, when used for treating the interior of radio cabinets, will practically eliminate resonance and definitely reduce distortion due to reflection effects.

The Modern Loud Speaker

Extension Units and Quality Reproducers

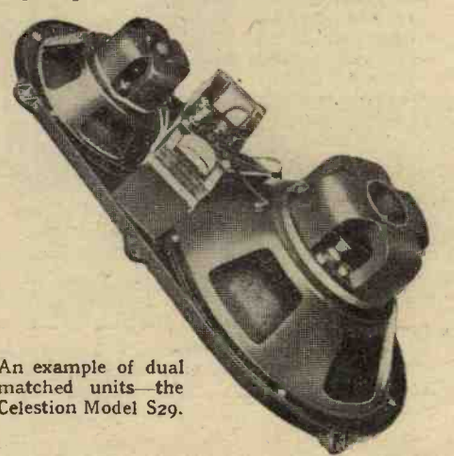
IN the loud speakers fitted as standard to the majority of moderate-priced receivers a tendency to stereotyped performance is to be noted. There is, however, no lack of diversity in the loud speakers manufactured for sale as separate units, and it is in this category that we may look for new and original developments.

IN the early days of broadcasting makers of receiving apparatus invariably left the choice of a loud speaker to the discretion of the purchaser, just as the motor car manufacturer expected his customer to find his own lighting equipment and accessories. To-day the loud speaker is as much an integral part of the commercially produced set as electrical equipment is of the modern car. But the fact that every car now has its standard lighting set has not diminished the sale of auxiliary spot lights or fog lamps, and special head lamps with optically worked lenses are still in demand at £20 or £30 a pair.

The Rothermel piezo-electric "tweeter" has a useful frequency range from 3,500 to 12,000 cycles and a sharp acoustic cut-off below 3,000 cycles.

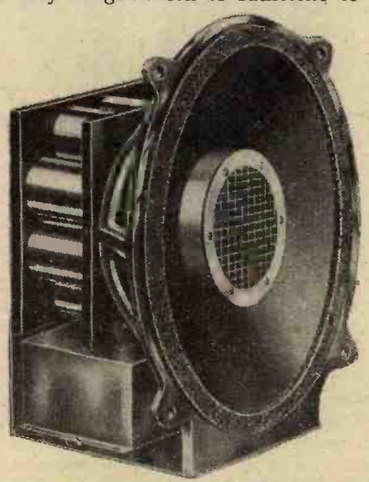
In the loud speaker field a very similar state of affairs exists at the present time, and there is a market both for extension loud speakers for use as accessories to existing sets and for specially built reproducers designed to meet the demands of those who are prepared to build receivers with the necessary frequency response to do them justice.

The demand for high quality of reproduction has never been more insistent than it is at the present time. Those who have been fortunate enough to listen to a wide-range reproducer are seldom satisfied until they have found some means of extending the frequency response of their own equipment to a similar extent.



An example of dual matched units—the Celestion Model S29.

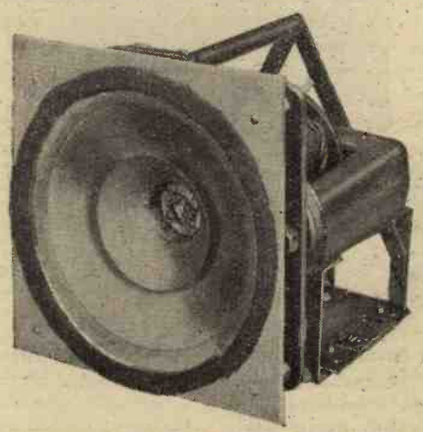
It has often been argued that the inertia of the moving parts in a loud speaker is the principal factor governing the reproduction of transients, but experience indicates that, provided the frequency range extends far enough in the top, the reproduction of transient sounds will be amazingly realistic, even though the mass of the moving parts responsible for the low notes may be quite considerable. Now that "tweeter" units are becoming available to the general public it is not difficult to extend the frequency range of existing loud speakers, provided, of course, that the receiving set is already delivering these frequencies to the output stage. Theoretically, it is desirable to use electrical filters to separate the component frequencies passed to the low- and high-note loud speaker units, but the majority of the existing high-note units have an inherent acoustic cut-off at the lower end of their frequency range which is sufficient to prevent serious overlapping. In the case of horn-type units the cut-off is determined by the diameter of the flare of the horn, and in the case of piezo-electric units by the diameter of the cone diaphragm.



A large-diameter cone for the bass and a moving-coil "tweeter" for the treble are merged in the Blue Spot "Super Dual.

Combining Dual Units

It is, therefore, quite feasible simply to connect the "tweeter" in parallel with the existing loud speaker, and quite satisfactory results will be obtained provided that the low-frequency unit does not show a pronounced resonance in the region of the overlapping of the frequency ranges, and that the unit is of a type which will not be damaged mechanically by the large amplitudes associated with the low-frequency components of the transmission. Capacitative units, such as those of the piezo-electric type, tend to by-pass the higher frequencies from the larger unit, and the possibility of over-accentuation in the overlapping region is thereby reduced. On the other hand, troubles may arise due to the resonance of the "tweeter" capacity with the inductance of the output transformer, and unless a suitable low-frequency unit is already in use it is probably better to invest in a complete assembly in which the matching troubles have already been cleared up by the manufacturer.



Designed for use with a horn baffle, the Voigt moving-coil unit has a subsidiary diaphragm which becomes a strong radiator of energy in the extreme top.

There are several alternative and equally successful methods of extending the frequency range without resorting to the use of a separate unit. In one case a subsidiary cone of small diameter and acute angle is attached to the moving coil on the apex of the main diaphragm. At high frequencies the sound energy is transmitted directly into this small cone, and the junction of the main cone is sufficiently resilient to by-pass vibrations which might otherwise pass into the main cone. At low frequencies the small diaphragm is carried as a passenger, and only slightly increases the mass of the

A hard bakelised cone material gives good response to high frequencies in the Hartley Turner loud speaker.

The Modern Loud Speaker—

system as a whole. Much can be done to strengthen the upper register by the use of a hard material for the main diaphragm, but this method requires skilful handling if resonances are to be avoided.

The Magnavox Model "Sixty-Six" is equipped with a powerful energised field magnet.

For those who have not yet had experience with a wide range reproducer a word of warning is necessary. An extended high-frequency response tends to accentuate clicks and background noises due to interference from electrical machinery, and the wide-range reproducer can only be fully enjoyed in districts which are free from this trouble. In such cases it is better to invest in one of the better-class single-diaphragm units, which, although they may only go up as far as 5,000 or 6,000 cycles, are capable of handling the range below these frequencies really well. In all the best examples

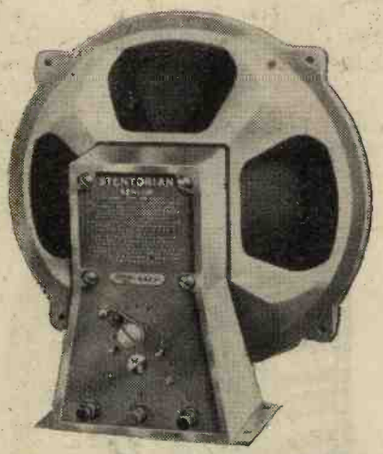
An example of the application of nickel-aluminium alloy in a quality loud speaker of the permanent-magnet type—the Goodman's "12 watt" unit.

of this type it will be found that the secret of success is a high flux density in the gap. This is easily recognised in the energised type by the physical dimensions of the magnet system, and the new nickel-aluminium alloy has improved the performance of the equivalent permanent-magnet types beyond recognition.

There are many who hold that the horn-type loud speaker, on account of the improved air loading and the fact that the diaphragm is not called upon to develop such large amplitudes, is capable of better quality of reproduction than the latter type of unit. Unfortunately, a horn of sufficiently large dimensions to ensure adequate reproduction of the bass is far too large to accommodate in the average room, but a reproducer has recently made its appearance in which a big step forward has been made in the solution of the problem. It is designed to fit in a corner of the room, and the walls form an extension of the loud speaker baffle. The dimensions have further been reduced by the judicious use of reflectors, and the lower frequencies, which might be attenuated by the restricted dimensions of the horn, are strengthened by a special "bass chamber" with an outlet in the floor of the cabinet. The characteristics of this reproducer are almost identical with those of a straight horn having virtually four times the volume.

Matching Devices

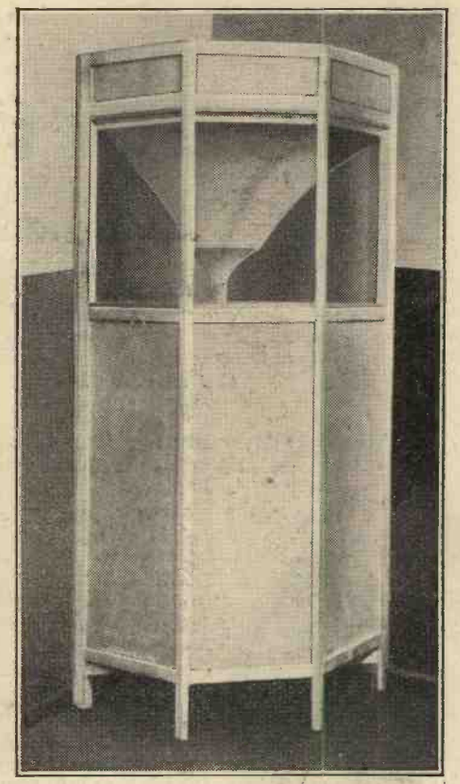
Apart from quality reproducers, the most important class of separate loud speaker units are those used as extension units for existing receiving sets. The matching requirements for an extension unit differ widely from set to set. Some sets are designed for a high-impedance load on the extension loud speaker terminals, while others require a load of not more than one or two ohms. For the low-impedance loud



Rapid comparison of results with different matching ratios is made possible in the W.B. "Stentorian" units by the rotary tapping switch.

speaker it may be said that the effects of capacity between the leads is negligible, but, on the other hand, the resistance may become comparable with the impedance of

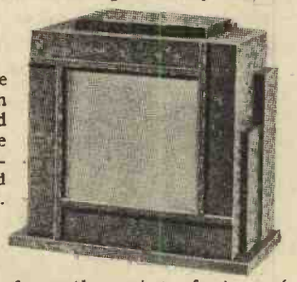
The principle of "impedence tuning" with a switched multi-ratio transformer is incorporated in the R. & A. "Multi-Mu" loud speaker.



Designed to fit into a corner of the room, the latest Voigt domestic loud speaker retains the acoustic characteristics of its large-sized "straight" horn equivalent.

the moving coil. In the case of the high-impedance unit the reverse is the case, and the resistance of the leads may be neglected, but capacity is important. As many sets employ pentodes in the output stage, however, and as a by-pass condenser is probably already fitted in the set itself, the extra capacity of the leads may be neglected.

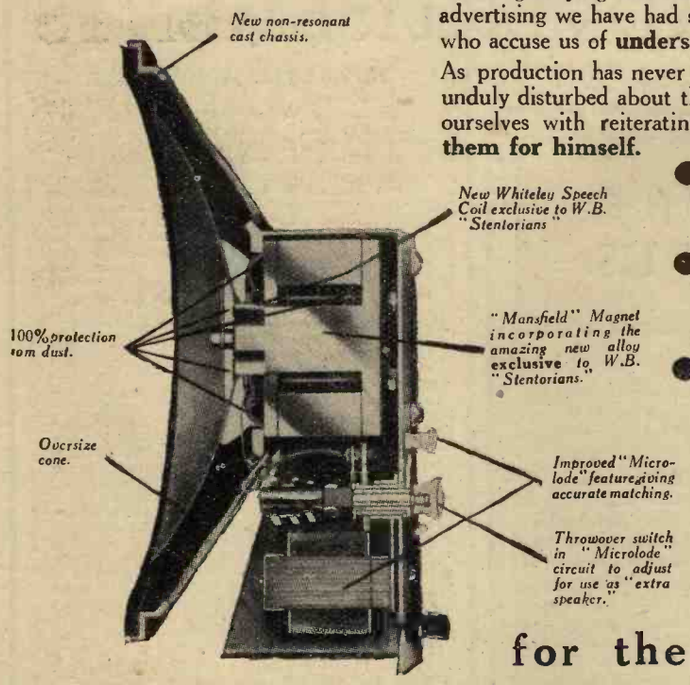
The problems of matching are solved in the majority of extension loud speakers by the use of a multi-radio output transformer. While this may result in some slight loss of efficiency on a few of the ratios, there can be no doubt that this policy is the correct one, for the user who is not certain of the correct ratio to employ can at least adjust his loud speaker by ear to



A typical example of the modern extension loud speaker—the Baker "Fydelitone" in moulded bakelite cabinet.

the best results from the point of view of efficiency and quality of reproduction.

One great advantage of an extension loud speaker is that it can be installed in the room in the best position from an acoustic point of view. The fact that many sets are equipped with a "silencing key" for the internal loud speaker suggests that instructive experiments might be carried out by way of comparison. In fact, we may find ourselves at some not far distant date back in the position of the pioneers with receiver and loud speaker invariably built as separate units—the latter without any of the restrictions imposed by the limitations of the receiver cabinet.


New non-resonant cast chassis.
New Whiteley Speech Coil exclusive to W.B. "Stentorians"
"Mansfield" Magnet incorporating the amazing new alloy exclusive to W.B. "Stentorians."
100% protection from dust.
Oversize cone.
Improved "Microlode" feature giving accurate matching.
Throwover switch in "Microlode" circuit to adjust for use as "extra speaker."

It is a gratifying fact that the only correspondence commenting on our advertising we have had so far has been from W.B. "Stentorian" users, who accuse us of **understating** our case!

As production has never quite caught up to public demand, we are not unduly disturbed about that; and in this advertisement we shall content ourselves with reiterating our claims and inviting the reader to **test them for himself.**

- The **exclusive** magnetic material (prov. pat.) used in W.B. Stentorians provides **nearly double the flux** of any other at similar cost. Therefore sensitivity and range of reproduction are superior to those obtainable in any other way.
- The new "Whiteley" speech coil brings crisper attack and better bass response. It has enabled us to place the bass resonance lower in the scale, and obtain a more natural and colourful reproduction of low notes. Top response is adequate up to broadcasting limits.
- The improved "Microlode" device, giving accurate matching and also enabling the "Stentorian" to be used—without alteration—as a **low-impedance "extension" if desired,** brings better "balance" of reproduction **(see "Wireless World," 9/11/34).**

Many thousands of "Stentorians" are now being used in the homes of radio enthusiasts, and nine dealers out of ten stock them. Test one for yourself.

MODEL PMS1

Stentorian Senior (PMS1)	42/-
(100 per cent. dust protection. Oversize cone.)	
Stentorian Standard (PMS2)	32/6
Stentorian Baby (PMS6)	22/6

Write for the new W.B. Stentorian leaflet.

EXCLUSIVELY SPECIFIED

for the BATTERY SINGLE SPAN IV

STENTORIAN

PERMANENT MAGNET MOVING-COIL SPEAKERS

Whiteley Electrical Radio Co., Ltd. (Dept. W), Radio Works, Mansfield, Notts.

Sole Agents in Scotland: Radiovision Ltd., 233, St. Vincent Street, Glasgow, C.2. Sole Agents in I.F.S.: Kelly and Shiel, Ltd., 47, Fleet Street, Dublin.

The GIFT that will be Valued for years!

For everyone who is radio-minded, the AvoMinor is the supreme Xmas Gift. It gives a pleasure that will endure, for it ensures improved and permanently trouble-free set performance. Every fault can be quickly traced—every radio problem solved at home.

The AvoMinor is TEN separate testing meters in one, giving ten *different* ranges of direct readings in milliamps, volts and ohms. No other combination instrument affords such convenient testing facilities with such dependable accuracy.

The AvoMinor is the ideal gift to give AND to receive. Suitably contained in a handsome presentation case with comprehensive instruction booklet showing how to make every test.

THE D.C. **AVOMINOR** REGD. TRADE MARK

TEN PRECISION METERS IN ONE

Fully descriptive Folder free on application.

If any difficulty in obtaining the Avo-Minor locally, write direct to the manufacturers:—

AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.

Winder House, Douglas Street, London, S.W.1. Victoria 3404-7

"RADIO SERVICING SIMPLIFIED"

This invaluable book makes a welcome gift. It is a complete survey of radio testing in non-technical language. The testing of modern valves and every phase of fault-finding are explained in easy phraseology. Numerous diagrams. A book that fills a long-felt need, and will meet with enthusiastic appreciation.

2/6

Post free 2/9.

MISCELLANEOUS ADVERTISEMENTS

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SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue: 13 consecutive insertions 5%; 26 consecutive, 10%; 52 consecutive, 15%.

ADVERTISEMENTS for these columns are accepted up to **FIRST POST on MONDAY MORNING** (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on **SATURDAY MORNING** at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26B, Renfield Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made payable to ILIFFE & SONS Ltd., and crossed ~~& Co.~~ Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

IMPORTANT NOTICE.

Owing to the Christmas Holidays, the issue of **"THE WIRELESS WORLD"** for December 21st must be closed for press earlier than usual.

The **MISCELLANEOUS ADVERTISEMENTS** for insertion in that issue can be accepted up to **FIRST POST, FRIDAY, DECEMBER 14th.**

Let Manufacturers' Surplus, Clearance and Bankrupt Stocks offered in any of these columns may not be Manufacturers' current lines. Radio components advertised at below the list price do not carry any manufacturer's guarantee.

RECEIVERS AND AMPLIFIERS, ETC.

ARMSTRONG.—1935 Radio Chassis Programme.

ARMSTRONG.—Latest 5v. bandpass supeheterodyne chassis, with fully delayed A.V.C., 7 highly efficient tuned circuits, bandpass input, Marconi Heptode frequency changer, combined 1st detector and oscillator, bandpass I.F. coupled to Marconi H.F. pentode, bandpass coupled to Cossor Double Diode, giving distortionless detection and A.V.C., resistance coupled to Mazda high slope pentode, Marconi bi-phase rectifier, full vision illuminated tuning, calibrated in wavelengths, combined radio and gramophone volume control, corrected pentode output, giving exceptionally good reproduction; £6/18/6, with valves, royalties paid.

ARMSTRONG.—Universal superheterodyne chassis, A.C. or D.C. mains, specification as superheterodyne described above, complete with Mullard valves, royalties paid.

ARMSTRONG.—Latest 4-valve, 3-pentode, Radiogram chassis, A.C. mains, incorporating 3 tuned circuits, full bandpass tuning, horizontal drive calibrated in wavelengths, combined radio and gramophone switching, 3 watts output; this well designed chassis has good selectivity with noiseless background; £5/18/6 complete, ready to switch on with the addition of a speaker.

ARMSTRONG.—Universal 4-valve A.C. D.C. Radiogram chassis, specification as above; £5/18/6 complete.

ALL Armstrong Chassis are Constructed of the Highest Grade Components Throughout, carry 12 months' service free guarantee, and are sent on 7 days' approval, carriage paid.

ARMSTRONG MANUFACTURING Co., 100, King's Rd., N.W.1. 'Phone: Gulliver 3105. [7140

UTILITY SALES.—This week's selection well called the super bargain:—

COMPLETE 5-valve 200-250 A.C. set, 3 S. grid Pentode, rectifier, energised moving coil, illuminated dial, chassis built in splendid cabinet, volume to fill hall, 40-50 stations from Normady to Budapest, not midget, 12-month guarantee; £4/15/6, carriage paid.

UTILITLY SALES, Faeritone Corner, 57, Praed St., London. Paddington 0251. [7157

AS OTHERS HEAR US

Extract from report in the December "Gramophone" on the Hartley-Turner S.12 receiver and the Hartley-Turner loud speaker mounted in the "True-Bass Boffle."

"The first thing to note is that an output power of 12 watts A.C. is more than is usually thought necessary for any home conditions. But there is a great feeling of ease when one knows that there are ample reserves to be called on when required—as, for example, when a heavy orchestral passage approaches a climax. One does not have to apologise either to another or to oneself because a heavy note just began to crack. We believe in having a large margin of power, particularly for local transmissions, with which one expects to be able to achieve a high standard of quality.

We have already stated or implied that this is an instrument of quality. But that does not by any means completely describe our judgment of it. Indeed, we find it a little difficult to put our views into words, for even a casual hearing is sufficient to indicate that *the characteristics are different from those of any other commercial receiver that we have tested.*

No one who is familiar with what has been achieved in the art of sound reproduction can have the slightest doubt that *this Hartley-Turner approximation to realism is a particularly close one.*

. . . One need only itemise its solid achievements. . . .

1. There is not a trace of bass boom.
2. There are no obtrusive middle register resonances.
3. Frequencies up to over 10,000 cycles per second are strongly reproduced.
4. Speech is clear and articulate with none of that 'chestiness' with which we are so familiar in reproduction.
5. Definition and resolving power as between different instruments of the orchestra and as between different people in an assembly is of a very high order.
6. A violin is readily distinguished from a flute and an oboe from either; timpani have the right skinny quality, and are not cavernous; applause is sharp and explosive; tambourines, triangles and the like are quite distinct and recognisable."

In other words:

THE RECEIVER AND SPEAKER THAT ROLL AWAY THE ACOUSTIC FOG.

Illustrated literature free on request.

HARTLEY TURNER RADIO LTD.,

Thornbury Road, Isleworth, Middlesex.

Telephone: HOUnslow 4488.

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For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box ooo, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

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Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

Receivers and Amplifiers, Etc.—Contd.

PHILIP KAY (Victoria) Christmas Set Bargains:—

£6/19/6.—Craven 5-valve superhet, 200-250-volt, Plessey chassis, Magnavox moving coil, complete with B.V.A. valves, in futuristic walnut cabinet, full 3 watts output, listed £14/14.

£6/6.—Fox Industrial 4-valve superhet, 200-250 D.C., complete with latest H.F. pentodes and Magnavox M.C., in superb walnut cabinet, listed £13/13.

29/6.—S.G.3 battery receiver, 2-gang Polar tub, Ormond L.S., in dark oak cabinet, listed £8/15 (without valves).

CALL and Inspect; over hundred sets to choose from; c.o.d. or c.w.o., carriage forward.

PHILIP KAY, Ltd., L7 Strutton Ground, S.W.1. [7161

KOLSTER-BRANDES 4-valve A.C. Superhet, listed £12/12, perfect condition; £7/7.

ULTRA Lynx A.C. Radiogram, listed £18/18, perfect condition, shop soiled; £11/11.

FOX 4-valve A.C. Superhet, listed £13/13, complete, as new; £7.—58 Flat, Mantell St., N.1. [7174

SEVERAL A.C. Wireless Sets, complete; from £2; taken for debt.—After 7 p.m., "Oakdene," Camden Rd., Carshalton. [7042

EDDYSTONE Kilodyne Four, 13 to 500 metres, with valves, 6 months old; sacrifice, £4/10.—A. Bromwich, Myton, Warwick. [7149

OUR Kit of Parts for "Wireless World" Quality Amplifier, complete in every detail, including valves; amplifier only, £8/10; feeder unit, 36/-.

OUR Kit of Parts for "Wireless World" Olympic S.S. Six, complete in every detail, including valves and loud-speaker; £14/10.

OUR Kit of Parts for "Wireless World" Standard A.C.3, complete with valves and spcaker; £11/10.

SEND for Detailed List of Components for Either of the Above Kits; carriage paid, cash with order.

WARD, 46, Farringdon St., London, E.C.4. 'Phone: Holborn 9703 [6907

A.C. Single Span, Rich and Bundy transformer, other components first choice, well constructed, little used; 12 guineas.—Hustwayte, 50, Bow Lane, London, E.C.4. [7124

B.S.R. Radio Unit.—Band pass, 2 V.M. valves, perfect job ready to use with B.S.R. or any good amplifier, cost £12/15; accept £5.—Jackson, Britannia Pier, Great Yarmouth. [7138

£6/19/6.—Regentone 6-stage 5-valve recent model superhets, straight-line Lucerne dial, square-fret super walnut cabinet, B.V.A. valves, 200-250 A.C., listed £14/14, as brand new.

£5/15.—Regentone band-pass 4, superb job, as above, 200-250 A.C., B.V.A. valves, listed £11/11, as brand new.

£3/15.—Regentone Class B 4-valve, Rola M.C. square-fret walnut cabinet, without valves, as brand new; £4/15, ditto 4-valve superhet.

CHASSIS of Any of the Above at Knockout Prices.—Coy, 23, Filmer Rd., Fulham, S.W.6. [7178

"Radio Data Charts," A Series of Abacs Post free 4/10

Receivers and Amplifiers, Etc.—Contd.

DEGALLIER'S Offer Brand New 1935 Receivers, Midget and Otherwise, all guaranteed, S.A.E. with all enquiries, illustrated lists of sets over £6/5.

MIDGETS, Emerson, 5-valve A.C./D.C., 100-250 volts, M.C. speaker, A.V.C. tone control, illuminated dial, pick-up terminals, M. and L. wave, cabinet 11¼×5½×7, at £4/5, post 1/3.

THE Following all R.C.A. Victors (H.M.V. in U.S.A.).

MIDGETS, 5-valve A.C./D.C. 100-250v., tone control, A.V.C., illuminated dial, P.U. terminals, M. and L. wave M.C. speaker, can also be run from batteries with adaptor included, at £6/5 (11½×7×5¾).

MIDGETS, 6-valve A.C./D.C. 200-250v., 13-50, 190-550, and 1,000-2,000 metres, P.U. terminals, A.V.C. illuminated dials, M.C. speaker, guaranteed to get many ultra short-wave stations, including America, at £7/7; carriage 2/- (14×16×9½).

TABLE Model, 14×16×9½, 3 watts undistorted, 5-valve, 7-stage, A.V.C. tone control, airplane dial 8in. M.C. speaker, M. and L. wave, P.U. terminals, approximately 80 stations on medium band alone, Universal A.C./D.C. 200-250v., at £7/7; A.C. model, £7/10 (carriage 4/-); less cabinet, £6/16/6 each.

TABLE Model, 19×16×10½, 3 watt undistorted, 6-valve 8-stage, fitted as in previous model, covering 13-50, 190-550, and 1,000-2,000 metres, receives on ultra short waves alone approximately 25 stations; A.C./D.C. model, £9/5; A.C. £9/10; carriage 4/9 (sensitivity 1 microvolt absolute).

TABLE Model De Luxe, cabinet alone cost £4/15, 21×11½×17, 6-valve, 8-stage, in 4 wave bands, maximum efficiency over whole wave band, coverage 12-2,000 metres, specification as in previous two models, world's first double intermediate super het.; by means of this revolutionary system it is possible to obatin maximum efficiency on all-wave bands, sensitivity guaranteed to be better than ½ microvolt absolute; supplied in A.C. only; 200-250 volts at £15; carriage 6/-.

DEGALLIER'S, 6, Coryton House, 21, Upper Marylebone St., London, W.1. Museum 7795. (Nearest stations Oxford Circus, Tottenham Court Rd., Goodge St., Great Portland St. Also 3, 59, 58, 137 buses pass the door.) [7177

1935 Manufacturer's Stock, 4-valve A.C. Band-pass receivers, walnut cabinets, Mazda valves, Rola speakers; £5/10; satisfaction or money refunded; cash with order.—Maude, 1, Martin St., Brighouse. [7116

PUBLIC Address Amplifiers, A.C. mains, 21 watts undistorted output, £15; 9 watts, £10; A.C.-D.C., 9 watts, £11; 3½ watts, £9; high quality receivers, £12; trade supplied; deferred terms.—D. E. Clarkson, B.Sc.(Eng.), 10, Park Rd., Wallington, Surrey. 'Phone: Wallington 3953. [7079

ZETAVOX 8 Superhet., A.V.C., A.C., new, £5; Lotus Bud 2-valve, A.C., new, £1/10; D.C. eliminators, Ekco, Philips, etc., 7/6 to 15/-; Ekco A.C.12 £1, A.C.18 £1/5; Lissen 7 Skyscraper kit and cabinet, £3, new; S.H. sets from 10/-.—Inglis, Westgate Rd., Bury St. Edmund's. [7146

EMERSON, the world's finest superhet. 4-, 5- and 6-valve receivers, long, medium, and short wave, all the latest A.V.C. models, just released, first consignment in this country; also 6-valve car radio; send for catalogue.—Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, E.18. [7153

7-VALVE Superhet. Alba Chassis (by Plessey), 7 tuned stages, delayed, A.V.C., local distance switch, 7 kc. separation, Mullard valves, A.C. 200-250 volts; demonstration daily at 94, High Holborn; chassis complete with Mullard valves, brand new, less speaker and cabinet, £7/10.—Radio Clearance, 94, High Holborn, W.C.1. [7119

FIRST Consignment of Emerson 1935 "Round the World" 6-valve Superheterodyne, 19-2,000 metres, 3 separate wavebands, acclaimed by trade as the best all-wave receiver yet produced, aeroplane dial tuning, "Duo-Lite" band switching, dynamic speaker, automatic volume control, gramophone pick-up, walnut cabinet 16¾in. high, 13¼in. wide.—Write for wholesale catalogue to Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, London, E.18. [7016

5-VALVE Superhet Chassis (7-stage), complete, wired, ready to switch on, speaker the only extra required, 9 kc. separation, A.V.C., all components by world-famous British manufacturers—Polar, T.C.C., Wearite, etc., B.R.V.M.A. valves, 12 months' guarantee, ideal for fitting to existing cabinet, bookcase, grandfather clock case, and other attractive housings; A.C. model £6/18/6, universal model £7/7, carriage paid; 7 days' approval; deferred terms if required; fullest particulars on request.—Westminster Chassis Co., Ltd., 4, Westminster Palace Gardens, London, S.W.1. [7135

CHAL-ELECTRIC Have Stock of Brand New Guaranteed 1935 10 guineas Atwater Kent 5-valve Midgets, complete in every detail, fitted with R.C.A. valves (replacements supplied at any time for these or other receivers) 43, 6A7, 6D6, 75, 77, 78, 25Z5, 12Z3, at 7/6 each (these also R.C.A.); these receivers operate on any voltage, A.C. or D.C., 100-250, with Universal adaptor included; illuminated dial, tone control, A.V.C., L.T.M. wavebands, pick-up terminals, moving coil speaker, in handsome walnut cabinet, 11½×5¾×7, ready to plug in; £4/6/3, carriage paid; cash with order or c.o.d.—Chal-Electric, No. 6, Conduit St., London, W.1. Museum 7795. [7176

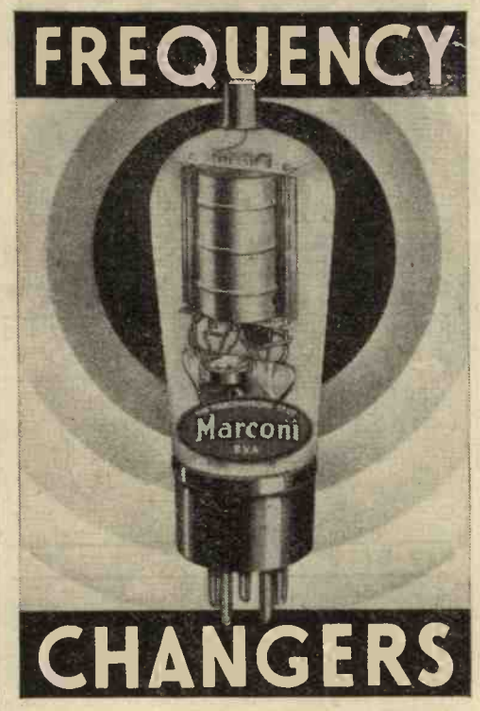
MAINS EQUIPMENT.

PEARL and PEARL, 190, Bishopsgate, London, E.C.2. —All the following bargains guaranteed new goods; cash or c.o.d., carriage paid.

SPECIAL Christmas Bargains.

ELIMINATORS.—Special purchase of large quantity of Lincoln-Stewart eliminators enables us to offer them at sacrifice prices; all models K.K. for 200-250v.; D.C. 25 milliamp. output, 9/11; A.C. 30 milliamp. output, with Westinghouse rectifier, etc., 24/11, or with half amp. trickle charger incorporated, price only 37/6; all fully guaranteed. See other bargains in Components Section.

ALL Mail Orders Direct to Pearl and Pearl, 190, Bishopsgate, London, E.C.2. Tel.: Bishopsgate 1212. [0421

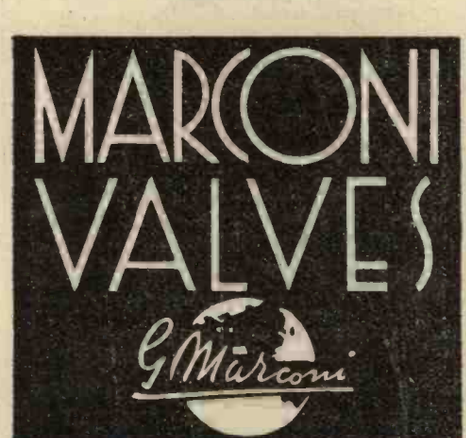


● A very high efficiency, approaching 1.5 m.A./V., can be obtained with a Marconi MS4B as frequency changer. If, however, A.V.C. control is required, this figure is reduced some 60% or more, as the rectifier efficiency drops very considerably. Thus we are led to employ the Heptode, which also possesses important advantages as regards simplicity and even operation over a wide range of frequencies.

The Marconi range therefore includes these Heptodes:—

Marconi X21 for 2 Volt Batteries.
Marconi MX40 for A.C. Circuits:
Marconi X30 for A.C., D.C. and Car Radio.

Send a card to The Marconiphone Company Ltd., Radio House, Tottenham Court Road, W.1, for the new Marconi Valve Catalogue and helpful information on Short Wave and broadcast reception



THE CHOICE OF THE EXPERTS

Mains Equipment.—Contd.

V.

VORTEXION Specified.

STANDARD A.C.3 Transformer, polished die cast, shrouding guaranteed 5 years; £1; chassis 6/-, choke to match, 12/3; see also displayed advertisement on page 9, November 9th.

STANDARD A.C.2 Transformer, 18/-; choke to match, 10/6; 5 years' guarantee.

VORTEXION Specified Olympic S.S. 6 Transformer, S.S.352, 5 years' guarantee, 25/-; less terminals and guarantee, 21/-; power chassis, £3/17/6; choke, 12/6; Single Span model, 25/-; power chassis, £3/10.

VORTEXION.—Quality Amplifier or Super Monodial, 425-0-425, 120 m.a., 4v. 8-8a. C.T., 4v. 3a. C.T., 4v. 1a., 4v. 1a., super shrouded, core size 2½in.×1½in., 2½% regulation primary engraved insulated terminals, weight 14lb., 26/-, carriage 2/-; normal shrouded, 22/-; open type, 20/-, post 1/3; speaker field replacement choke, 16/-; special output transformer to "W.W." specification, 12/6, post 9d.; state valve and speaker; "W.W." universal output transformer, £1; normal 40h. 50 m.a. primary cutput transformers, 10/6, post 9d.

VORTEXION 7.30h 120 m.a. Choke, 215 ohms, in die cast shrouding to match; 12/6.

IMITATED, but unequalled. Good enough for a "Wireless World" specification is good enough for you.

VORTEXION Cost Little More than the Cheapest, but unequalled by the dearest.

VORTEXION A.C./34, used by author in construction of A.V.C Three, as illustrated; 18/-.

GUARANTEED 12 Months, and within 5% normal and 2½% super models, neat shrouding, with detachable feet, as used by Government Departments, etc., etc., any model guaranteed 5 years at extra cost of 2/-.

ALL Secondaries Centre Tapped.

VORTEXION.—250-0-250 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., open type, 10/-; shrouded, 12/6; post 9d.

VORTEXION.—Ferrocart III 350-0-350, 60 m.a., 4v. 2.5 C.T., 4v 3.5 C.T.; open type 13/6, shrouded 16/-; post 9d.

VORTEXION.—Super model for H.T.8 or 9 or 10, 4v. 1 to 2, 4v. 2 to 4, open type 14/6, shrouded 16/6; post 1/-.

VORTEXION.—350-0-350, 120 m.a., 4v. 2 to 5a., 4v. 2 to 4a., 4v. 2.5a.; open type 14/6, shrouded 16/6; super shrouded model, weight 11lb., 4 filaments to specification, 21/-; post 1/3.

VORTEXION.—400 or 450 or 500v., 120 m.a., 4v. 2 to 5, 4v. 2 to 5, 4v. 2.5a.; open type 19/-, shrouded 23/-.

VORTEXION.—400 or 450 or 500, 150 m.a., 4v. 4a., 4v. 2.5, 4v. 2, 4v. 2, 4v. 2, core size 2¼×1in., a super job, 2% regulation 35/-, shrouded, with terminals; less terminals, 30/-; open type, 26/-; post 1/3.

VORTEXION Auto Transformers to B.E.S.A. Specification, 100, 110, or 120v. to 200, 220, or 240 volts, 60 watts, 9/-; post 9d.; 120 watts, shrouded 12/6, open type 10/6, post 1/-; 200 watts, shrouded 16/6, post 1/-; 2,000 watts, £4/10.

VORTEXION 1,000-watt Transformers; £4/10/-, carriage free.

VORTEXION 30h. at 60 m.a., Chokes, 5/6; 40h. at 60 m.a., 8/6; 30h. at 150 m.a., 200 ohms, 10/6 open type, 12/6 shrouded.

VORTEXION Transformers Made to Your Specification; price according to wattage, 6v. filaments same price unless wattage grossly exceeded; special quotations by return.

VORTEXION (S. A. BROWN), 182, The Broadway, Wimbledon, S.W.19. Tel.: Liberty 2814. [6954

PARAMOUNT Mains Transformers Lead in Price and Quality.

PARAMOUNT Transformers are Suitable for all "W.W." Circuits.

PARAMOUNT Transformers Guaranteed for 2 Years, and the best British materials, 2½ mils. thick insulating paper between each layer, with standard primaries, 200-250v. 50 cycles, all secondaries C.T.

PARAMOUNT 250-0-250v. 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., open type, 9/-; shrouded, 11/-; post 9d.

PARAMOUNT Ferrocart III. 350-0-350v. 75 m.a., 4v. 2-5a., 4v. 3 to 5a., open type, 12/-; shrouded, 14/-; post 9d.

PARAMOUNT Transformers Made to Your Own Specification; price according to wattage; quotations by return.

PARAMOUNT 350-0-350v. 120 m.a., 4v. 2.5a., 4v. 4a., 4v. 5a., open type, 14/-, shrouded, 15/6; post 1/-.

WE are Proud of our 5-valve Super Inductance Receiver; write for details; price £9, complete in walnut cabinet.

PARAMOUNT 400v., 450v. or 500v. 120 m.a., 4v. 2.5a., 4v. 4a., 4v. 5a., open type 17/, shrouded 19/-, post 1/3; 150 m.a. with 2 extra filaments (not exceeding wattage), open type 22/6, shrouded 25/-, post 1/3.

PARAMOUNT Super Models.—H.T.8, 9 or 10, 4v. 1 to 2a., 4v. 2 to 4a., open type, 14/-; shrouded, 15/6; post 1/-; don't pay high prices for your mains components.

PARAMOUNT Auto Transformers, 100-120v. to 200-250v. or vice versa, 60-watt, 8/-; 120-watt, 9/6; shrouded, 1/- extra; post 9d.

PARAMOUNT Mains Chokes, 30 h. 60 m.a., 5/6; 20h. 120 m.a., 8/-; post 9d.

PARAMOUNT Guaranteed Electrolytic Condensers, 4+4 mfd., 500 peak; price 3/6; post 3d.

PARAMOUNT Mains Transformers Manufactured by R. H. Salter, 66, Hartfield Rd., Wimbledon, S.W.19. Tel.: Liberty 3226. [6929

TANTALUM for A.C. Chargers, H.T. and L.T.—Blackwell's Metallurgical Works, Ltd., Garston, Liverpool. [6470

BATTERY Chargers.—The "N.P." (late Nash Products) have the lowest prices yet still maintain quality; trade lists free.

BATTERY Chargers.—"N.P." from 50/- to £15; charging plants of highest quality.—N.P. Electric Co., 514, Alum Rock Rd., Birmingham. [7152

Mains Equipment.—Contd.

P.

PARTRIDGE, B.Sc.(Eng.), A.M.I.E.E., A.I.Rad.E.

PARTRIDGE Transformers.—"Certainly above the average . . very soundly constructed transformers."—*Wireless Trader.*

PARTRIDGE Transformers:—"Runs perfectly cool . . . sound electrical job . . . represents very good value."—*Wireless World.*

PARTRIDGE Transformers:—"Voltage regulation excellent . . . transformer remained remarkably cool."—*Radio Trade Review.*

PARTRIDGE Transformers.—Guaranteed 12 months, screened primaries, 200-250v., 50 cycles, all L.T.s centre tapped.

SPECIFIED by *The Wireless World* for the Standard A.C. Two:—"Partridge" transformer, 12/9; "Partridge" choke, 7/3.

PARTRIDGE Transformers.—250-0-250v., 60 m.a., 4v. 1a., 4v. 2-4a., 11/-; 350-0-350v., 60 m.a., 4v. 2-2½a., 4v. 2-4a., 13/6.

PARTRIDGE.—350-0-350v., 80 m.a., 4v. 2-2½a., 4v. 2-4a., 4v. 1a., 16/6; 350-0-350v., 120 m.a., 4v. 2-2½a., 4v. 3-5a., 4v. 1-2a., 18/6.

PARTRIDGE.—425-0-425v., 120 m.a., 4v. 2-2½a., 4v. 3-5a., 4v. 2a., 20/6; 500-0-500v., 100 m.a.. 4v. 2-2½a., 4v. 3-5a., 4v. 2a., 21/-.

PARTRIDGE.—500-0-500v., 120 m.a., 4v. 2-4a., 4v. 3-6a., 4v. 1-2a., 4v. 1-2a., 27/6; larger types supplied to order.

PARTRIDGE.—0-7½-9-11v., 1-3a., 10/-; 0-15-18-22v., 1-2a., 10/-; 240v. (tapped 200v.), 200 m.a., 4v. 2-4a., 12/6.

PARTRIDGE.—Step-up or step-down auto transformers, tapped 0-100-110-200-230-250v., 60w., 10/-; 100w., 12/6.

TRANSFORMER for "W.W." Single-Span, 18/6; for "W.W." P.P. Quality Amplifier, 27/6; for "W.W." Olympia S.S. Six, 18/6; for Standard A.C. Three (specified), 13/6.

PARTRIDGE Transformers.—Wound to any specification, accuracy of output guaranteed, competitive prices, quick delivery.

OUTPUT Transformers.—"Partridge" officially recommended by Messrs. Tungsram for their 21w. output valves.

OUTPUT Transformers.—5w. to 100w. speech, no audible distortion, 32-10,000 cycles, designed for any conditions for relay of P.A. work; see "W.W." test report, Oct. 19, 1934.

PARTRIDGE Chokes.—Give rated inductance at full-current; curves supplied on request.

PARTRIDGE Chokes.—140H., 60 m.a., 2,500 ohms, 13/6; 75H., 25 m.a., 1,400 ohms, 7/6; 25H., 60 m.a., 560 ohms, 7/3.

PARTRIDGE Chokes.—22H., 120 m.a., 350 ohms, 9/9; 13H., 200 m.a., 160 ohms., 12/-; 8H., 120 m.a., 225 ohms, 6/9.

PARTRIDGE Chokes.—6H., 500 m.a., 50 ohms, 19/6; 3H., 250 m.a., 70 ohms, 6/6.

ALL Advertised Lines Supplied from Stock.

PARTRIDGE.—Trade enquiries solicited.

PARTRIDGE, B.Sc.(Eng.), A.M.I.E.E., A.I.Rad.E.

PARTRIDGE, N., Kings Buildings, Dean Stanley St., London, S.W.1. Tel.: Vic. 5035. [6749

HOYNE'S Transformers are Manufactured by Engineers with 14 Years' Experience in Radio Transformer Design.

HOYNE'S.—The acknowledged finest value in transformers and chokes.

HOYNE'S.—Used exclusively by many established set manufacturers, relay stations, transmitters, and Government Departments.

HOYNE'S.—Section wound, paper interleaved, filaments, centre tapped, aluminium clamps and terminal strips to all models.

HOYNE'S.—Specified by "Wireless World," and wound strictly to the specification of the author.

HOYNE'S.—Standard A.C.2 transformer, 300-0-300v., 60 m.a., 4v. 2.5a., 4v. 2a., price 12/6, post 1/-; 20h. 75 m.a. choke, 8/6, post 9d.

HOYNE'S.—Standard A.C.3 and Ferrocart III transformer, 350-0-350v., 60-70 m.a., 4v. 2.5a., 4v. 4a.; price 12/6, post 1/-.

HOYNE'S.—Push-pull Quality Amplifier transformer, 25/-, post 1/3; 7/30 henrys choke, 9/6, post 9d.; 20 henrys, 7/6. post 9d.

HOYNE'S.—Single Span, 15/-, post 1/-; choke, 10 henrys, 7/6, post 9d.

HOYNE'S.—Everyman A.C. super transformer, 12/6, post 1/-; choke, 10 henrys, 7/6, post 9d.

HOYNE'S.—A.V.C. Straight Four transformer, 18/-, post 1/3; choke, 26 henrys, 120 m.a., 140 ohms, 9/6, post 9d.

HOYNE'S.—250-0-250v. 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., 10/-, post 9d.; with extra 4v. 1 to 2a. winding, 12/6, post 1/-.

HOYNE'S.—Ferrocart III, 350-0-350v., 60-70 m.a., 4v. 2 to 3a., 4v. 2 to 4a., 12/6, post 1/-; with extra 4v. 1 to 2a. winding, 13/6, post 1/-.

HOYNE'S.—350-0-350v., 120 m.a., 4v. 2 to 3a., 4v. 4 to 6a., 4v. 1a., 4v. 1a., 18/-, post 1/3.

HOYNE'S.—400 or 450 or 500v., 120 m.a., 4v. 2 to 3a., 4v. 2 to 5a., 4v. 1 to 2a., 18/-, post 1/3.

HOYNE'S.—500-450-0-450-500v. 140 m.a., 4v. 2 to 4a., 4v. 4 to 6a., 4v. 2a., 4v. 2a., 27/6, post 1/3; weight 11lb.

HOYNE'S Transformers, built to specifications, keenest prices, best materials and workmanship; quotation by return.

HOYNE'S.—All advertised types from stock.

HOYNE'S.—Open from 9 a.m. till 7 p.m., including Saturday.

M. J. HOYNE, ALL-POWER TRANSFORMER, Ltd., Offices and Works, 8a, Gladstone Rd., Wimbledon, S.W.19. Tel.: Liberty 3203. [7068

14/11—Battery chargers, 1 amp., 2-6v., incorporating Westinghouse rectifier, ½ amp.; 10/-; 7 days' cash approval; postage 9d.; list free.

22/-—Arden eliminators, 20 m.a.; test before purchasing; particulars free.—Arden Agency, Wollaston, Wellingborough. [7131

PILOT AUTHOR KITS

Exact to Specification

NEW SINGLE SPAN • BATTERY FOUR •

KIT "A" CASH OR C.O.D. CARRIAGE PAID. £6 - 12 - 6 or 12 monthly payments of 12 3.

KIT "A" Author's Kit of first specified parts, including ready drilled Plymax baseboard and polished Plywood Panel, less valves, cabinet and speaker.

KIT "B" As for Kit "A" but including set of 4 specified valves, less cabinet and speaker. Cash or C.O.D. Carriage paid. £9 15 0. Or 12 monthly payments of 17/9.

KIT "C" As for Kit "A" but including valves and Peto-Scott cabinet, less speaker. Cash or C.O.D. Carriage Paid .. .. .. £11 10 0 Or 12 monthly payments of 21/-.

KIT-BITS *You pay the Postman. We pay post charges on all orders over 10/-. GREAT BRITAIN ONLY*

1 Peto-Scott ready-drilled Plymax Chassis 9"×14"×2¼"	7s. 0d.
1 Peto-Scott ready-drilled polished Plywood Panel 14"×10½"	2s. 0d.
1 Wearite set of 4 Coils	7s. 6d.
1 Wearite Aerial Filter	13s. 6d.
1 Eddystone 973 Tuning Dial	10s. 6d.
1 set of 4 Specified Valves	£3 2s. 6d.

CABINETS

C.A.C. Cabinet, as specified	Prices on application.
PETO-SCOTT Cabinet, built to specification by Peto-Scott's Expert Craftsmen. In handsome figured Walnut	£1 15s. 0d. Carriage 2/6 extra

EXPORT ORDERS Simply send full cash value plus a suitable amount for half carriage charges and any surplus will be immediately refunded. Packed free, we pay half carriage. Air Mail charges extra. PETO-SCOTT, established in 1919, are the largest Radio-by-Mail House in the World. Hire-purchase terms are NOT available to Irish or Overseas Customers.

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77 CITY RD., LONDON, E.C.1 'Phone: Clerkenwell 9406/7

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Est. 1919.

50 ohms to 100,000

A DEFECTIVE Resistance can completely ruin the enjoyment of radio—and frequently does. Moreover, it is often difficult to trace the fault, as none but the most expensive testing equipment can definitely locate it.

When building your next set, or overhauling your present equipment, change over to Amplion resistors. They are colour coded, compact and sturdy, and all values are *wire-wound*, this method of construction giving the most reliable and constant form of resistance.

PRICE EACH 1/- ALL VALUES

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AMPLION

1-WATT WIRE-WOUND RESISTORS

Obtainable from all Dealers.

AMPLION (1932) LTD.

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Mains Equipment.—Contd.

LESDIX Chargers, all steel, A.C. and D.C. mains, 2 to 200 cells at low prices; state requirements; dynamos and rotaries in stock, all sizes; battery superseders for 2-volt input, 80-volt output, 37/6; fractional H.P. and sewing machine motors, 25/-.—Below.

LESDIX Measuring Instruments, 2¾in. bakelite case, flush panel, any reading, A.C. or D.C.; from 6/- each; ask for full range instrument list.—Below.

LESDIX Microphone.—We are makers of 25 types for all uses; Home Radio mikes, solid bakelite body, 5/6; G.P.O. microphones, on stand, with mouthpiece, 7/6; P.A. mikes, 50/-; list free.—Electradix Radios, 218, Upper Thames St., London, E.C.4. [0398

CABINETS.

MANUFACTURERS' Clearance.

SET and Speaker Cabinets; 5/- upwards.

S.T.600, dark walnut finish, for set and speaker, undrilled; 21/-.

RADIOGRAM Cabinets; 37/6 upwards.

SPEAKER Cabinets; 4/6 upwards.

SEND Particulars of Your Requirements (giving size of set, etc.), or call and make your choice from our stocks of over 100 different types; from 3/6 to £4/10.

MOTORS for Radiograms or Gramophones, clockwork or electric from 5/-, list on application.

H. L. SMITH and Co., Ltd., 287-9, Edgware Rd., London, W.2. Tel.: Padd. 5891. [7130

DYNAMOS, ETC.

M-L Convertor, input 6-12v., output 350v. 80 m.a.; £5/10.—Harwood, Woodland Villa, Leeds, 8. [7127

UNLIMITED Supplies Again.—Rotary converters, brand new, in sealed crates (Waites "Standard Batteries"), D.C. input, 200-240, output A.C. 230v. at 80 watts, at £3/10; also (6 only) 180-watt models, voltage input and output as above, at £4/10; also (10 only) 180-watt models, 110 D.C. input and 110 A.C. output, necessary condensers can be supplied for smoothing above if you have not already a filter unit, 1,500 test, 500 A.C. working. 4 mfd., 4/-; 2 mfd., 2/6; owing to weight, carriage forward goods.—Degallier's, 6, Coryton House, 21, Upper Marylebone St., London, W.1. Museum 7795. [7175

GRAMOPHONES, PICK-UPS, RECORDERS.

PIEZO Electric Pick-up, 35/-; Bowyer-Lowe, Mark IV, 30/- both new.—Jackson, Britannia Pier, Great Yarmouth. [7139

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MAGNAVOX Sixty-Six Speaker, A.C. model, almost unused; £5, or offer.—Dewar, 4, York Rd., Edinburgh, 5. [7147

HARTLEY Tuner, 1933, guaranteed perfect condition, with A.C. rectifier and output transformer; 55/-.—Smith, 20a, Lower Stone St., Maidstone. [7123

CELESTION Permanent Magnet Speakers; Model P.P.M.10, 10½in. cone, with multi ratio transformer, 35/-; Model P.P.M.79, in oak, walnut, or mahogany cabinets, 45/-.

M.C. Horn Units; Racon, Truvox, American Amplions, 6v. field, £2 each.

MANUFACTURERS' Surplus Stock of M.C. Speakers; Celestion and other well-known makes, 450, 2,000 ohms, less output transformer; 8/6 each.

TERMS, cash with order or c.o.d.; carriage forward.—H. Franks, 23, Percy St., Tottenham Court Rd., W.1. Museum 8585. [7155

HULBERT, 6, Conduit St., W.1.—Read below: If you are requiring realistic reproduction at remarkably low cost, send for one of the following high-grade speakers; repeat orders are coming in daily.

10/6 Only!!—Brand new manufacturers' surplus moving coil speakers, made by one of the best known British maker; energised, 2,500 or 6,500 ohms field, power or pentode transformer, 8in. cone; 10/6 each.

12/6 Only!!—As above but with 10in. cone, a very powerful speaker capable of handling large outputs.

15/6 Only!!—Brand new manufacturers' surplus moving coil speakers, made by one of the best known British makers; permanent magnet model of high efficiency, with power or pentode transformer, 8in. cone; 15/6 each.

17/6 Only!!—As above but with 10in. cone; ideal for use with quality receivers.

19/6!—Permanent magnet speakers with high efficiency Alni magnets, 8in. cone; 19/6.

24/-!—As above, but with 10in. cone; 24/-.

2/9 Only!!—Brand new cabinets, suitable for any of above speakers; 2/9 each only; secure one of these amazing speaker bargains now; repeat orders are coming in daily; cash with order, or c.o.d.—Hulbert, 6, Conduit St., W.1. [7077

MAGNAVOX D.C.152 (9in. cone), 22/6; Magnavox 154 (6¼in. cone), 16/3; all with humbucking coils, power or pentode transformers, and 2,500- or 6,500-ohm fields; Magnavox P.M.254, 18/-; Magnavox P.M.252, 22/6.

ATTENTION to All Orders Within 24 Hours; carriage paid; cash with order or c.o.d. Send for list.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [6404

A FEW H.M.V. Speakers Left; 100 ohms., 2,500 ohms., 6,500 ohms., 35/-; Rothermel, permanent magnet speakers, 19/6; Marconi D.C., 35/-; Epoch 6 volt field, 30/-.—J. F. Anderson, 35, Landsdowne Rd., Walthamstow, E.17. [7169

VAUXHALL.—Magnavox permanent magnets, universal, suitable for Class "B," power or pentode, 7in. cone 17/6, 10in. cone 23/-; mains energised, 2,500 or 6,500, 10in. cone, 22/-; 7in. cone, 15/3; brand new, with humbucking coils; state power or pentode transformer; unused manufacturers' stock; immediate delivery, carriage paid, cash with order or c.o.d.—Vauxhall Utilities, 163a, Strand, W.C.2. Temple Bar 9338. [7163

Loud-Speakers.—Contd.

MOUNTGROVE SUPPLIES.—Reputable manufacturers' surplus; guaranteed genuine Alni P.M.s, handsomely finished in black and chromium, real quality speakers giving a flat response from 40 to 10,000 c.p.s.; 8in. 5 watt model, 7,500 lines in gap, maches any output, including Class B, 25/-; Auditorium model, handles 11 watts, 50,000 line Alni magnet, will respond to 32 c.p.s. without frequency doubling, 20 ratio transformer, 10in. cone, 78/6; also 3ft. exponential horns, to fit 7in. or 8in. speakers, 15/6.—76, Mountgrove Rd., N.5. [7148

TELEVISION.

UNISPHERE Mirror Drum, adjusted, 25/-; D.1 mercury tube, suitable above, 25/-.—119, Golders Green Rd., N.W.11. Speedwell 3744. [7126

TRANSMITTING APPARATUS.

QUARTZ Oscillating Lens; 1/2 each, post free.—Resonators, 71, Siddall St., Oldham. [7133

VALVES.

METROPOLITAN RADIO SERVICE Co. for American Valves with a Guarantee, any type at keenest prices; trade supplied.—1021, Finchley Rd., Golders Green, N.W.11. Speedwell 3000. [0436

AMERICAN Valves, brand new, R.C.A. and Raytheon; 224's, 235's, 551's, 247's, 9/9; 227's, 245's 280's, 6/9; and most other types; cash or c.o.d.—Norman Michel, 51, St. Matthew's Parade, Northampton. [7005

SURPLUS Valves—All brand new; battery types, 2-volt, H.F.2, L.F.2, L.P.2, 1/9; super power, P.P.2, 2/6; screens and pentodes, 3/9; A.C. mains, 4-volt 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid; cash with order, or c.o.d. over 10/-.—Clarion Radio Valve Co., 885, Tyburn Rd., Erdington, Birmingham. [6339

ALL Types of Brand New American Valves in Stock, only first-class makes such as Arcturus and R.C.A. stocked, guaranteed for 6 months, 247, 235, 551, 89, 18, 19, 46, 59, 6A7, 15, 42, 41, 38, 39, 78, 75, 57, 58, 224, 44, 36, 235, 83, 43, 5Z3, 12/-; 25Z5, 12Z3, 14/6; UX171, UX 199, UX280, UX245, UX226, UX227, 7/6; UX250, UX210, UX231, 17/6; UX 867 photocells, 25/-; all other types of American valves in stock; we also stock transmitting valves, post paid, cash with order or c.o.d.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [6517

COMPONENTS, ETC., FOR SALE.

R.

RYALL'S RADIO, 44, Lamb's Conduit St., London, W.C.1. Callers note: we are just off Theobald's Rd., best approach from Holborn through Red Lion St. Holborn 3529. Hours 11 to 7 p.m., Saturdays 5 p.m., Thursdays 1 o'clock.

SPECIAL Offer of Igranic 3-gang "Straight" Type Condensers, split vanes, trimmers, and trimming key, with cover, brand new and guaranteed matched up, 0.0005, standard in every way; 6/6, post 9d.

DECONTROLLED Sets, Ultra Panther Pedestal Type 6 Valve and Rectifier Superhet, brand new, to clear, £10; Lotus 2v. D.C., new, original make, £4/10; genuine Emerson, A.C.-D.C., £6.

VARLEY 500,000 ohm Wire Wound Resistances, 9d.; Lewcos S.W. intermediates, 4/-; pairs new Polar thumb drive 0.0005 condensers, with double escutcheon plate, 7/6 pair to clear; Garrard Junior B.D./S. motor, with unit plate, etc., new 15/-.

WIRE, new Knifetown, etc., ½lb. reels, 16 swg. En., 8d.; ½lb. 18 swg. C.C., 8d.; ¼lb. 20 swg. En., 6d.; ¼lb. 32 swg. En., 9d.; 2oz. 20, 30, 32, C.C., 6d. each; 1lb. 26 swg. D.C.C., 1/6; ¼lb. 34 swg. D.C.C., 9d.

NEW Ecko K. 25 Eliminators 150v. 20 m.a., with ¼ amp. trickle charger, 45/-; Sonochorde 2,500 ohm speakers, with tapped transformer, 10/6; Met-Vick 250v. transformers, 4v. 2a., 4v. 5a. input, 200-250v., with terminals, 11/-, new; Varley Pentode Nichokes, new, 6/-.

T.C.C. 0.1 Non-inductive Tubular Condensers, wire ends, 10d. each; 350 vw. T.C.C., 0.01, mica, type M, 1/-; T.C.C., M type, mica condensers, 0.0001, 0.0002, 0.0005, 0.001, 3d. each; ditto, 0.005, 6d. each; T.C.C. 15 mf. 100 vw. electrolytic, 1/4; T.C.C. 50 mf. 12 vw. electrolytic, 1/4; T.C.C. 0.1×0.1 450 vw., 1/6.

T.C.C. 8 mf. Wet Electrolytic, 440 vw., 2/9; T.C.C. 8 mf. dry electrolytic, 500 vw., 3/9; Dubilier Mansbridge 2 mf. 250 vw., 1/6; H.M.V. condenser blocks, 4×4×1×1×0.5 250 vw., 3/-, post 9d.; Wego, British, condenser blocks, containing 4×4 mf. at 350 vw., and 1×1×1×0.1×0.1×0.1 at 250 v.w., 4/-, post 9d.

HEAYBERD Transformers, new, with leading-out wires, 500v. 120 m.a., 4v. 4a., 4v. 6a., 4v. 2½a., 32/6; screened primary and input 200-250v.; carriage forward.

RYALL'S RADIO Offer Reliable Resistances, suitable for all sets where a 1-watt resistance is specified, in values 100, 150, 250, 500, 400, 500, 600, 1,000, 2,000, 5,000, 10,000, 15,000, 20,000 25,000, 30,000 40,000, 50,000, 75,000, 100,000, 150,000, 250,000, ½ meg., 1 meg., 2 meg., all values stated in ohms, 4d. each; also 2-3-watt type, 400, 700, 800, 1,000, 4,000, 5,000, 6,000, 10,000, 20,000, 9d. each, wire ends.

RADIOPHONE Volume Controls with Switch, 5,000, 10,000, 15,000, 20,000, 2/6; also 10,000 graded 9-1 with 3-P switch, 25,000 graded 9-1 with 2-P switch, 3/6.

POLAR Minor 3-gang Condensers, with "Arcuate," or "Semi Circular" drive, new; list 24/6, 14/6.

RYALL'S RADIO Offer British-made Mansbridge Condensers, metal cased, brand new, fully guaranteed, 1 mf. 400 vw., 1/3; 2 mf. 400 vw., 1/6; 4 mf. 400 vw., 3/-; 4 mf. 750 vw., 6/-.

READY RADIO 0.0005 Extensor Condensers, new, 2/6; Yagerphone S.G./Det./Pen. and rectifier chassis, with valves complete, 65/-.

NEW Garrard No. 11B D/S Motors, 12in. turntable and fully automatic unit plate, all fittings included; less than half price, 20/-.

R. and A. Type Output Transformers, 18-23-32-1, new, 5/-; Paxolin formers, with guides, 1in., 8d.; R.I. Hypermite transformers, 4/-, second-hand; R.I. Parafeed transformers, 5/-, secondhand.

RADIOPHONE Disc Drives, less escutcheon, fit 5/16in. spindle, read 0-100 from left to right; 1/6 post free.

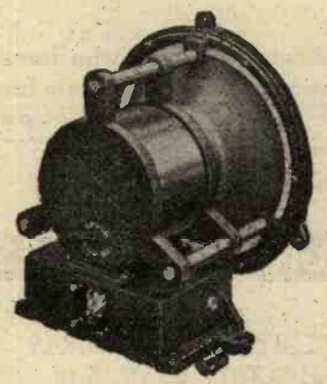
R. [7156

The True Spirit
— of —
Christmas

is entirely free from discordant notes. So, too, should be the reproduction from your loud speaker.

Get the real Christmas Spirit into your home this year with an

EPOCH
DOMINO ENERGISED MODEL



The Domino is designed for those who insist upon Quality. We doubt if you have heard a domestic speaker as sensitive or more true to life. Only when you fail to realise that music and speech are being electrically or mechanically reproduced can you claim "near-perfection."—and this is what the Domino gives.

Type 101½E. Unit for 4-12 volts	£5 . 15 . 0
Type 101½F. Unit for D.C. mains	£6 . 15 . 0
Type 101½J. A new unit for A.C. and D.C. by a quick change-over device	£9 . 5 . 0
Handsome Walnut, Oak or Mahogany Cabinet, extra	£4 . 4 . 0

MOVING COIL MICROPHONE

EPOCH Microphones should not be confused with the more popular and apparently inexpensive types. They are a great advance over Carbon and Condenser types, having much greater sensitivity. The quality is perfect at ALL frequencies. Being designed for serious work there is an entire freedom from distortion and from external and internal noises.

Type 44. On swivel table stand without input transformer.	£4 . 4 . 0
Type 44T. Ditto, with input matching transformer.	£5 . 5 . 0
Floor Stand. Extra.	£1 . 1 . 0

FREE. Upon application fully illustrated catalogue will be sent by return.

SERVICE. Send your problems to our Technical Enquiry Bureau. We shall be glad to help you.

Trade Enquiries invited.

EPOCH
REPRODUCERS & MICROPHONES

Made and Distributed by

THE RADIO DEVELOPMENT CO.

Aldwych House, Aldwych, LONDON, W.C.2

Telephone: Holborn 9111

Components, Etc., for Sale.—Contd.

PREMIER SUPPLY STORES

ANNOUNCE a City Branch at 165 and 165a, Fleet St., E.C. (next door to Anderton's Hotel) for the convenience of callers; post orders and callers to High St., Clapham.

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra; I.F.S. and abroad, carriage extra; orders under 5/- cannot be sent c.o.d.; please send for illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v. 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker; £12/10.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps., C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200 v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps., 25 hys., 4/-; 65 milliamps., 30 hys., 5/6; 150 milliamps., 30 hys., 10/6; 60 milliamps., 80 hys., 2,500 ohms, 5/6; 25 milliamps., 20 hys., 2/9; 250 milliamps., 30 hys., 20/-.

ALL Premier Guaranteed Mains Transformers Have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; with Westinghouse rectifier, giving 200v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v. 60 m.a. and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a., and 4v., 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Mains Transformers, output 350-0-350v. 120 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt; 10/-.

WESTERN Electric Mains Transformers, 300-0-300v. 65 m.a., 4v., 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a., C.T., 4v. 1a., C.T.; 19/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-110v. or 200-250v., output 180-0-180v., 40 m.a., 4v. 1 amp., 4v. 3 amps., 4/6; 200-0-200v., 4v. 1a., 4v. 3a.; 4/6.

PREMIER L.T. Charger Kits, consisting of Premier transformers and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Traspeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/- complete.

SPECIAL Offer B.T.H. Gramophone Motors, A.C. and D.C., 100-250v.; 30/-, listed £3/3.

COLLARO Gramophone Unit, consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job; 15/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-; 200 ohms, wire wound, 1/-.

POLAR Star, manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11;; Utility bakelite 2-gang 0.0005, screened, with uniknob trimmer, 3/6; Polar bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

ORMOND Condensers, 0.0005 2-gang semi-shielded, 2/6; brass vanes with trimmers, 3/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna., 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 16/6.

RELIABLE Canned Coils with Circuit Accurately Matched, dual range, iron cored; 2/11.

UTILITY 3-gang Condensers, 0.0005, fully screened, with trimmers, ball bearing, straight or superhet., 6/9, complete; with disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-; 2 mf., 750v. working, 3/-.

VARLEY Constant Square Peak Coils, band-pass type B.P.7, brand new, in maker's cartons, with instruction and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instructions, in original cartons; 2/6.

SCREENED H.F. Chokes, by one of the largest manufacturers in the country; 1/6.

PREMIER British-Made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 15,000, 20,000, 50,000, 90,000, 120,000, 200,000, 500,000, 2/- each; 1,000 ohm, semi variable, carry 150 m.a., 2/-.

PLESSEY Pick-up and Arm, 15/-; Cosmocord pick-up, with arm and volume control, 10/6.

RELIABLE Intervalve Transformers, 2/-; M.C. Multi-ratio output transformers, 2/6; 2-1 or 1-1 output transformers, 2/6; microphone transformers, 50 and 100-1, 2/6.

(This advertisement continued on next page.)

Components, Etc., for Sale.—Contd.

(This advertisement continued from previous page.)

BLUE SPOT 45 P.M. Speaker Multi-ratio Transformer, handles 4 watts; listed 45/-, at 25/-; or in handsome walnut cabinet, 35/-.

BLUE SPOT 99 P.M. Speaker Multi-ratio Transformer, handles 5 watts; listed 59/6, at 31/-.

SUPER Moving Coil Speaker by World Famous Radio and Gramophone Co., 10,000 ohm field (300v. 30 m.a.); 25/-.

PREMIER H.T.11 Transformer, 500v. 120 m.a., or 450v. 150 m.a., rectified, with 3 L.T. windings, 22/6; with Westinghouse rectifier, 42/6.

DARIO Valves, 4 volt battery type, H.F., R.C., L.F., power, 1/6 each; 4v. directly heated mains power, 1 watt, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers at a fraction of original cost, for callers.

THE Following Lines 6d. each, or 5/- Per Dozen: Chassis valve holders, 5-, 6-, or 7-pin, screened screen-grid leads, any value 1-watt wire resistances, wire end condensers, 0.0001 to 0.1, 3 amp. main switches. Cyldon capacitors, double trimmers.

SCOTT Aerial and Anode Coils, dual range, complete with circuit; 2/6 per pair.

BLUE SPOT 29 D.C. Moving Coil Speaker, with multi-ratio output transformer, 7in. cone, 2,500 ohms, 9/11; ditto 29P.M., permanent magnet, 18/9.

ELPHRO Volume Controls, 10,000, 12,000 or 15,000 ohms, complete with mains switch; 1/-.

T.C.C. Electrolytic Condensers, 8 mf., 440v. working 3/-; 4 mf., 440v. working, 3/-; 15 mf., 50v. working, 1/-; 50 mf., 12v. working, 1/-; 15 mf., 100v. working, 1/3; 6 mf., 50v. working, 6d.; 2 mf., 100v. working, 6d, 8+4 mf., 450v. working, 4/-.

DUBILIER Dry Electrolytic Condensers, 12 mf., 20v. working, 6d.; 50 mf., 50v. working, 1/9.

CONDENSER Blocks, H.M.V., 400v. working, 4+2+1+1+1+0.5, 3/9; 2+2+1+1+1+0.5, 3/-; Dubilier, 300v. working, 4+4+2+0.1, 3/-; Philips 6+4+2+1+1, 4/6.

RADIOPHONE Logarithmic Wire Wound Potentiometer, 10,000 ohms, with mains switch, 2/-; S.W. H.F. chokes 10-200 metres, 9d.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World-famous Continental Valve Manufacturer, all the following standard mains types, fully guaranteed, 4/6 each H.L., L., power, medium, high, low mag. and variable mu screen grids, 1-, 3- and 4-watt A.C. output, directly heated pentodes, 250v. 60 m.a., full wave rectifiers, D.C. types, 20v. 18 amps., filaments, screen grid V.M., H., H.L., power.

THE Following Types, 5/6 each; 350v., 120 m.a., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½-watt indirectly heated pentode.

THE Following American Types, 4/6; 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27.

THE Following Types, 6/6 each; 42, 77, 78, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A5, 2A6, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for catalogue of above types.

PREMIER SUPPLY STORES.

20-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest Station: Clapham North (Underground). [7171

MILDMAY RADIO EXCHANGE.

MILDMAY RADIO EXCHANGE Offers the Following Sound and Perfect; cash with order or c.o.d.

WIRELESS World Super Monodial, C.A.C. built and tested, complete with all valves and power pack, in brand new condition; £12.

WIRELESS World Quality Amplifier Sound Sales, built complete with valves, Feeder unit, also with valves; £9/10.

WIRELESS World Single Span Receiver only, complete with valves designed for use with the above; £5/10.

B.T.H. 1935 Senior R.K. D.C. Mains Energised Moving Coil Speaker, £3/10; Garrard 202A combined gramophone unit, complete with pick-up and volume control, £2/19/6.

COLLARO Type 32 Combined Gramophone Motors with Pick-ups and Volume Controls, fitted with fully automatic stop and start plate, 12in. turntable; 50/- each, listed £4.

SPECIAL Offer: Telsen L.F. Chokes 40 henry, brand new and in sealed boxes; 1/6 each, limited number only.

SPECIAL Clearance Offer: Telsen short-wave coil units, brand new and in sealed boxes; 1/9 each.

B.T.H. Needle Armature Pick-up, 27/6; pair Varley push-pull transformers, 22/6; J.B. Unitune 3-gang 0.0005 variable condensers, brand new, in sealed boxes, complete with drives; 11/6 each.

MUST Be Cleared: Special offer: 3-valve battery-operated receivers, in solid oak cabinets, detector, 2L.F., at the very low price of 14/- each; give one to your mother-in-law for Xmas.

WE Have a Very Large Stock of Battery-operated Receivers in Stock, to be cleared at very low prices to callers only.

FERRANTI A.F.4, 7/6; A.F.3, 10/6; A.F.5, 18/-; A.F.6, 18/-; A.F.7, 18/6; O.P.M.1., 10/-; O.P.1. 1-1 ratio, 7/6; O.P.2 25-1 ratio, 7/6; O.P.3(c) 1-1 P.P. output, 7/6; O.P.M.2, 10/-; O.P.M.3 12/-; O.P.M.4, 12/-; B3 chokes, 5/- each.

ALL the Above Post or Carriage Paid at Owner's Risk, unless otherwise stated.

WE are Open All Day Thursday, and until 9 o'clock on Saturdays.

'PHONE: Terminus 6751.

6, Pentonville Rd. (near The Angel), London, N.1. 2 minutes from Euston and King's Cross. Callers invited. [7160

FERRANTI A.F.5, 16/6; A.F.5 (c), 17/6; O.P.M.1(c), 12/6.—Benton, High St., Old Hill, Staffs [7141

FERRANTI A.F.6, A.F.7, 15/- each; A.F.8, new, 7/6; O.P.M.4, 10/-; Marconi K17 pick-up, 20/-; B.T.H. P.M. Junior, 12/-.—Aldridge, 29, Chatterton Rd., London, N.4. [7136

FERRANTI A.F.5, 17/6; A.F.5 (c), 19/6; A.F.5 (cc), 21/-; A.F.6, 17/6; O.P.M. 2(c), 13/6; O.P.M.6(c), 13/6; all perfect and guaranteed; cash with order or c.o.d.—Grigg, 70, Peel Rd., Wealdstone, Middlesex. [7137

A NEW BOOK!

QUALITY AMPLIFICATION

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SOUND SALES

Dedicated to those who have previously searched in vain for the ideal reproduction equipment.

SOUND S SALES LIMITED.

TREMLETT GROVE WORKS, JUNCTION ROAD, N.19.

Telephone: ARChway 1661/2.

Don't endanger your valves and your set by testing with inefficient, unguarded instruments. Eelex Testing Prods avoid all danger of accidental shocks and shorts. They are completely insulated, the testing points only being exposed when the Red or Black top is pressed. They will save their cost many times over. Price **3/6** per pair.

Write for List C.13.

J. J. EASTICK and SONS,

118, Bunhill Row, London, E.C.1.

(Met. 0314, 6 lines.)

Components, Etc., for Sale.—Contd.

SOUTHERN RADIO'S Wireless Bargains.

RECEIVERS.—G.E.C. Osram 4-valve (actual) sets, complete with 4 Osram valves, permanent magnet moving coil speaker, magnificent pedestal cabinet, ready to use on all voltages A.C., all Osram proprietary components in original sealed cartons; £6/15 (list £15/15); an exceptional bargain.

CROMWELL 3-valve Battery Sets, complete with three Cossor valves, permanent magnet moving coil speaker in magnificent walnut console cabinet, brand new, in original sealed cartons; £3/12/6 (list £9).

BURGOYNE Class "B" Receivers, 1935 series, brand new, in original sealed cartons, complete with 3 Mullard valves, Exide batteries and accumulator, P.M. moving coil speaker, contained in attractive cabinet, magnificently finished with chromium fittings; £3/19/6 (list £6/10).

COILS.—Igranic superhet, set of four (1 Osc., 2 I.F. with pigtails, 1 L.F. plain), 12/6 (list 50/-); Lissen superhet, 5-coil kit, screened, ganged on base with switch, type L.N.5181, 9/6; same description for band pass or any straight circuit, type L.N.5162, 7/-; Varley constant square peak coils, B.P.5, complete with all accessories in sealed cartons, 2/3; Lewcos, O.S.C./126 (extensor) T.O.S./R, all at 3/6 each.

PICK-UPS.—Marconi model K.25 (1935 issue), 21/- (list 32/6).

CONDENSERS.—Lotus 3-gang, 12/6; 2-gang, 8/6; all 0.0005, fully screened with trimmers, complete with dials, knobs and escutcheons; special bargain line, Plessey 4-gang condensers, superhet. type, fully screened with trimmers (less dials) (standard dial will fit), 10/6 (list 45/-); Dubilier block condensers, 4 mfd. (2×1×1), 1,000v., 2/9; 4.5 mfd. (2.25×2.25), 3/-; T.C.C. (0.1×0.01), 1/3 each.

SPEAKERS.—Blue Spot 66R. units, brand new and boxed, 10/6 (list 35/-); complete, mounted on Blue Spot chassis, 16/6 (list 45/-).

BLUE Spot Permanent Magnet Moving Coil Speakers, universal transformer for Class "B," Super-Power, Power, or Pentode, all brand new 1935 series, in sealed cartons; type 45P.M., 26/- (list 45/-); 99P.M., 30/- (list 59/6); 62P.M., in magnificent cabinet, 38/- (list 67/6); 32P.M., in exquisitely finished cabinet, 45/- (list 87/6), all brand new.

MISCELLANEOUS.—Set manufacturer's surplus skeleton type Westinghouse metal rectifiers, H.T.6, 7, 8, 9/3; morse tapping keys with flash signal and buzzer, complete with battery and bulb, 2/-; Lissen general purpose output chokes, 20-28 henries, 18-60 m.a., L.N. 5301, 6/- each; Lewcos superhet, dual wave frame aerials, 9/-; utility midget condensers, 0.0005, complete with dial, knob escutcheon, 2/6; Bifo static cut-outs, definitely cuts out all electrical interference and all unwanted noises without decreasing volume, listed at 12/6, our price 2/3 each; brand new and boxed, with simple instruction leaflet; please state whether A.C., D.C., or battery set; note price, 2/3 (listed 12/6).

THOUSANDS of Bargains for Callers at our Various Shops. We have enlarged and reconstructed our 46, Lisle St., premises, and it is now the largest wireless depot in the West End, with a full range of 1935 receivers, components, etc., at keenest prices.

ALL Goods Guaranteed and Sent Post Paid.

BRANCHES at 46, Lisle St., W.C.2; 16, Leicester St., W.; 271-275, High Rd., Willesden Green, N.W.10; all mail orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324. [7153

MAINS RADIO DEVELOPMENT COMPANY.

GUARANTEED Perfect Goods; study our prices; carriage paid; new list ready; trade enquiries invited.

ROTHERMEL Permanent Magnet Moving Coil Speakers. 7in. cone, Universal transformer, new, in original boxes; 15/-.

SONOCHORDE Energised Moving Coil Speakers, 7in. cone, Pentode transformer, 2,500, 6,500 ohms, new, in original boxes; 11/6.

CHASSIS.—Cadmium plated 3-valve chassis, 13½in.×7in.×2¾in., 1/-; chassis valve holders, new, 5-pin 2d., 7-pin 5d.; screened heater wire, 10ft. 9d.; radiophone toggles, 3-point 7d., on-off 5d.; Edibell, boxed, 0.0005 mfd., 2d.

CLEARANCE.—Manufacturer's surplus H.F. chokes, 4d.; 1 mfd. condensers, 300v. working, less fixing, 4d.; eminent maker; must be cleared.

T.C.C. Electrolytics, 25 mfd. 25 volt, 50 mfd. 12 volt, Bakelite case, 1/3; B.1 8 mfd., 550v. peak, 3/-.

BRITISH STANDARD Tubular Condensers, 800v. test, wire ends, brand new, 0.01, 0.02, 0.05, 0.1 mfd., 6d.; 0.25 mfd., 0.5 mfd., 8d.

FRANKLIN 1-watt Colour Coded Resistors, wire wound, wire ends, 100 to 100,000 ohms, your choice; 4d. each, 3/6 per dozen.

MAINS RADIO DEVELOPMENT COMPANY, 4-6, Muswell Hill Rd., London, N.6. Tudor 4046. [7128

WARD for Unparalleled Bargains in Set Manufacturers' Surplus; all goods are guaranteed perfect; immediate delivery.

OLYMPIC S.S. Six Coils, complete to specification, 45/-; A.C. and D.C. eliminators, first class make, tappings S.G., detector and power (150v., 25 m.a.); A.C. type with Westinghouse rectification, 25/-; D.C. type 12/-.

DUBILIER Resistances, 1-watt type 7d., 2-watt type 1/2, 3-watt type 1/9, Dubilier or T.C.C dry electrolytic condensers, 8 mfds or 4 mfds. 500v. peak, 50v., 50 mfds. or 200 mfds. 10v. peak, 3/6.

MARCONI K19 or K25 Pick-ups, 21/-; Rothermel piezo electric, 30/-; Cosmocord, 12/-; B.T.H. needle armature pick-ups, 29/-; B.T.H. pick-up tone arms, 3/-; Clix chassis type valve holders, 5-pin 5d., 7- or 9-pin 6d.; T.C.C. type "M" fixed condensers, any size up to 0.001 mfds., 6d.

SET Manufacturer's Surplus.—Skeleton type Westinghouse rectifiers, H.T.8 9/6, H.T.9 10/-, H.T.10, L.T.4, L.T.5, 10/9; transformers (Regentone) for H.T.8 or H.T.9, with 4v. 4a. L.T., 7/-.

CARRIAGE Paid, cash with order or c.o.d.; send for list.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [6516

Components, Etc., for Sale.—Contd.

WOBURN RADIO Offer Following Bankrupt Stock and Manufacturers Surplus:—

T.C.C. Condensers: Blocks, 20 mfd. (12 mfd.×4×2×2 mfd.), 5/6, 14 mfd. (2 mfd.×2×4×4×1×1), 5/-; 12.01 mfd. (4×4×2×1×1×0.01), 4/6; 6 mfd. (4×2), 2/6; 6.5 mfd. (2 mfd.×9.5), 3/-; 11 mfd. (4×4×2×1), 3/6; 9 mfd. (4×4×1), 3/-; 5.35 mfd. (4×1×0.1×0.25), 2/6; 3.1 mfd. (1×1×1×0.1), 2/-; 1.2 mfd. (1×0.2), 1/-.

ELECTROLYTICS: 6 mfd. 50v. working, 15 mfd. 100v. working, 25 mfd. 25v. working, 50 mfd. 12v. working, 1/3 each.

T.C.C. Mica Tag Condensers, type "S" and "M," 4d. each; values, 001, 0015, 003, 006, 0001, 0002, 0003, 00025, 0003, 0004, 0005, 0007, 0008, 0009.

DUBILIER Dry Electrolytics, 4 mfd., 8 mfd., 500v. working, 3/-; 50 mfd. 50v. working, 3/-; Mershom wet electrolytics, 500v. 8 mfd., 2/9.

FORMO 1 mfd., 1,000v. test, Bakelite, 1/-; 2 mfd. 1,000v. test, 1/3; Wego 4 mfd. 750v. test, 2/3; Tubulars: 0.1, 0.01, 0.02, 6d.; full range of T.C.C. tag condensers at 4d. each including unusual sizes, all types M.

BRITISH Radiophone Two Gang Condensers with Trimmers, 0005, 5/9; Radiophone curved dials with escutcheon and dial lights, 3/9.

ESTON Iron Cored Canned Coils, with circuit, 2/6; Radiophone toggles, 6d.; binocular chokes, 1/2; H.F. chokes, 10d.; Columbia L.F. transformers, 3/1 and 5/1, 2/9; J.B. air spaced condensers, 0005 with escutcheon, dial light and drive, 3/3; Class B driver and choke, 8/6; chassis mounting valve holder, 4-5-pin, 1/3 half dozen; 7-pin, 5d.; Edison condensers, 005 and 006, 4d.; Sistoflex, 7 yds. 6d.; screened sleeving, 3d. yd.

SONOCHORDE Speakers, D.C. energised, 2,000 ohms, new and boxed, 12/6 (carr. 1/-); Rothermel Midget P.M. speakers, power transformers, 12/-.

ROTHERMEL Piezo Electric Pick-ups, new model, boxed, listed 42/-, 30/-; Marconi K.25 pick-ups, boxed, 21/-.

WESTINGHOUSE Rectifiers, set manufacturers surplus skeleton type, H.T.8 and 9, 8/11; transformers for same with L.T. winding, 6/9; few only H.T.5 and 6 at 4/9.

G.P.O. Relays, magnificent instruments, few only, 10/- each.

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BENJAMIN-TRANSFEEDAS, boxed, 5/11; Epoch O.T.D.8 output, 9/11; Ferranti A.F.5c, 13/6; Q.P.P. inputs and outputs, 5/11.

MONODIAL Components, "W.W." I.F.s, 5/6; whistle filters, 6/11; Varley B.P.19 coils, 15/11; Polar Star 3-gang, with cyldon drive, 10/11; Ferrocart 110K.C. colverdynes, 6/11.

COREY-PARSONS A.C. 4-valve Superhet, Westinghouse, tone control, B.V.A. valves, £6/19/6; ditto, Class B Four, £5/19/6.

WESTINGHOUSE Rectified Chargers, to charge 2 to 12v. battery at 1a., £1/9/6; thermionic ditto, 12v. 2a., £1/11/6; kits for 2 amp. chargers, £1/8/6.

TELEVISION, 150 ohms sliders, 5/11; 130 ohm 1 amp. sliders, 32 ohm 2 amps. ditto, 8/11; ditto 30 ohms 3 amps., 15/6; 255 ohm nets, 3/6; tapped ditto, 750 ohms, for motor control, 3/11.

WESTINGHOUSE Rectified Eliminators, with 2-4-6v. chargers, output 150v. 30 m.a., with lower tappings, £1/17/6; 25 cycles, £1/19/6.

NON-INDUCTIVE 800v. Test Condensers, 1 mfd., 10d.; 2 mfd., 1/3; 4×4 mfd., 4/6; 8×8 mfd., 8/6; 1×1 mfd., 1/4; 0.25 mfd., 5d.; 0.01 mfd. 4d.; 10% discount on dozens.

NON-INDUCTIVE 1,500v. Test Tubulars, 0.0001 mfd. to 0.001 mfd., 2/11 per dozen; 0.002 to 0.006 mfd., 3/11 per dozen.

DRY Electrolytics, 500v. working, 8 mfd., 2/11; 25/- per dozen; ditto 25v. 25 mfd., 1/3, 13/6 per dozen.

W.B. Baseboard Valve holders, 4-pin, 2/11 per dozen; Clix 7-pin chassis, 6d.; British chassis type, 4-pin 1/9, 5-pin 2/3, 7-pin 2/11, per dozen.

COLOUR Coded Wire Wound Resistors, 1 watt values up to 1,500 ohms, 4/11; up to 5,000 ohms, 5/11; higher values, 6/11; per dozen.

2-WATT Resistors, add 1/- per dozen; 5-watt, add 2/- per dozen; 8 watt, add 3/- per dozen to above prices; 10 watt resistors, 2/- each; 20 watt, 2/6; 50 watt, 3/-.

MOULDED Resistors, 1 watt, wire end, 3/6 per dozen, various values; ditto, cap end over 0.1 meg. only, 3/3 per dozen.

MAINS Transformers, screened primaries, 200-230-250v., 350-0-350v. 80 m.a., 4v. 2a., 4v. 4a., 9/11; ditto 120 m.a., 12/9; 500-0-500v. 120 m.a., 3 L.T.s, 16/6; above with leads; add 20% for super type with terminals, etc.

25H. Smoothing Chokes, 60 m.a., 5/6; 100 m.a., 6/6; 150 m.a., 7/6; 200 m.a., 9/11; 30 m.a., 2/6.

E. MARSTON RUDLAND (Trustee), Chartered Accountant, 20, Waterloo St., Birmingham. [7134

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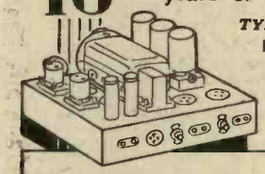

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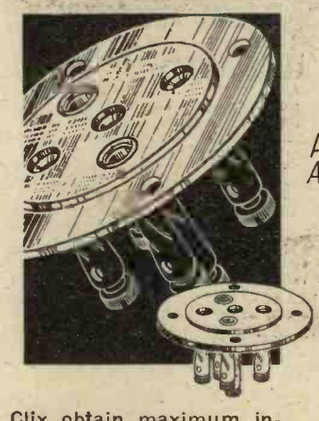

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RADIOMART.—Lissen 2-gang coil unit for screened grid circuit, switches, makers' unopened boxes, complete circuits (list 17/6); 5/11.

RADIOMART.—Utility super 2-gang air-spaced ball-bearing, fully screened, with trimmers, 5/11; with disc dial, 6/11.

RADIOMART.—Utility 3-gang superhet. 110 kc., 6/9; with disc dial, 7/11; Utility bakelite, 0.0001, 0.0002, 6d.

RADIOMART.—Utility straight line dials, wavelength, light moves with pointer, 3/6; Utility special disc dials for 5/16in. shaft condensers, 2/-.

RADIOMART.—T.C.C. 500vt., 4×4×1 mfd., 2/11; 4×4×2×1×1 mfd., 4/6; Dubilier 4 mfd. 200v. electrolytics, 1/3.

RADIOMART.—Lissen 12/6 chokes, 25 hy., 70 m.a., 4/6; 32 hy. output, 4/6; 3-1 Pentode output transformer, 4/6.

RADIOMART.—Special offer: dozen assorted wire-ended resistances, Dubilier, N.S.F., etc., all different, our selection; 2/6.

RADIOMART.—Slektun 6/6 dual range screened coils, 2/6; matched pair for screened grid, 4/6; complete circuits.

RADIOMART.—T.C.C. bias electrolytics, 50 mfd., 12v. 25 mfd., 25v., 1/3; 6 mfd. 50v., 1/-; 15 mfd. 100v., 1/6.

RADIOMART.—Igranic smoothing chokes, 20 hy. 100 m.a., 260 ohms, heavy stalloy core; 2/9.

RADIOMART.—Mains transformers, 350-350v. 120 m.a. 4v. 6 amps., 4v. 2½ amps., 4v. 2 amps., screened primary, super quality, made Western Electric, 8v. Cromwell superhet., 12/6; postage 1/-.

RADIOMART.—Edgewise visual tuning meters, 6 m.a., illuminated, 2¼×5⅛in. only, similar R.G.D.; 5/9.

RADIOMART.—Radiophone logarithmic potentiometer, 10,000 ohms, wire wound, with mains switch; 2/-.

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RADIOMART.—Brass air-spaced, variable condensers; 0.0005, 1/9; 0.0003, 1/3; real quality job.

RADIOMART.—Screened ironcore dual range coils, with reaction circuit, 2/11; Igranic short wave ironcore dual range, 3/3.

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RADIOMART.—Latest type Telsen components, disc drives, 1/9; slow motion dials, 1/6.

RADIOMART.—Telsen 7/6 Radiogrand transformers, 3-1 or 5-1, 3/9; tapped Pentode chokes, 3/6.

RADIOMART.—Telsen 1,500v. tubular condensers, 6d.; Telsen 1-watt wire-ended resistors, 6d.; cartridge, 6d.

RADIOMART.—Telsen differentials, 0.0001, 0.00015, bakelite variable, 0.0001, 0.00015, 10d.; 0.0003, 1/-; 0.0005, 0.00075, 1/3.

RADIOMART.—Brand new condensers, eminent maker, 500v., working 4 mfd., 3/6; 2 mfd., 1/10; 1 mfd., 1/6.

RADIOMART.—350v. working 4 mfd., 2/9; 2 mfd., 1/8; 1 mfd., 1/4; 250v. working 4 mfd., 2/3; 1 mfd., 1/2.

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RADIOMART.—Non-inductive tubulars, wire-ended, 1,500v., 0.1, 0.01, 0.02, 0.04, 0.05 mfd., 6d.; Philips, 0.0001, 0.001, 2d.

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RADIOMART.—Sonochorde 29/6 moving coil 2,500, tapped power. Pentode, makers' boxes; 10/6

RADIOMART.—Siemens 21/- super 4-pole cone units, 4/6; 35/- model, 6/9.

RADIOMART.—Shortwave specialists' reliable gear at commonsense price, direct supervision G.5N.I.

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RADIOMART.—Purchases over-produced stock leading Continental valve maker, super valves; sensational prices.

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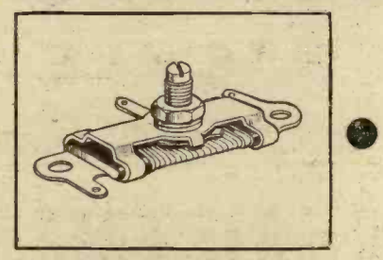
RADIOMART.—November list gives characteristics and hundreds of quality bargains; please note stamp must accompany enquiries.

RADIOMART.—Orders over 6/- post free.—The Square Dealers, 19, John Bright St., Birmingham. [7164



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AMPLION Binocular H.F. Chokes, totally enclosed in bakelite case, list 4/6, our price 2/3; lots of 3 dozen assorted Dubilier fixed condensers, 1/9 each lot; 4-pin chassis-mounting valve holders, 5d. each, 6 for 2/-; 7-pin type 7d. each, 6 for 3/-; variable tuning condensers, 0.0003 mfd., 1/- each; Igranic 2-port rotary switches, 1/- each; Igranic short-wave chokes, 1/- each; double reading voltmeters, 1/9 each; accumulator hydrometers, complete with float, 1/- each; Sovereign lightning arresters, 6d. each. Free: Revised Bargain List "W."

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RADIO CLEARANCE Offers 8 mfd. Dry Electrolytic, 500-volt working, well known make; 2/6 each.

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RADIO CLEARANCE Offers Mains Transformers, unshrouded, manufacturer's type, primary 200-250, secondary 320-0-320v. at 70 m.a., 2-0-2v. at 3 amps.; 6/6, post free.

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RADIO CLEARANCE Offers L.F. Transformers, 3:1 and 5:1, manufacturer's type; 1/6 each.

RADIO CLEARANCE Offers L.F. Transformers, shrouded, 3:1 and 5:1; price 1/9 each.

RADIO CLEARANCE Offers Steel Chassis, cadmium plated, drilled ready for use, 3-valve, 1/-; 4-valve, 1/6.

RADIO CLEARANCE Offers Metal Chassis 2- and 3-valve type, fitted with valve holders and terminal strip; 2/-.

RADIO CLEARANCE Offers "Centralab" Potentiometers, 50,000 ohms; price 1/6 each.

RADIO CLEARANCE Offers T.C.C. Condensers.—0.5 mfd., 200-volt D.C. working, 1/- each; T.C.C. condensers, 1 mfd., 250-volt D.C. working, 1/- each; T.C.C. condensers, 1 mfd., 450-volt D.C. working, 1/3 each; T.C.C. condensers, 1 mfd., 800-volt D.C. working, 1/6 each; T.C.C. condensers, 2 mfd., 450-volt working, 1/6 each; T.C.C. condensers, 6mfd., 250-volt D.C. working, 2/- each; T.C.C. condensers, 4 mfd., block 0.5, 0.5, 0.5, 0.5, 0.5 and 1 mfd., 250-volt A.C. working, 2/6 each.

RADIO CLEARANCE, 94, High Holborn, W.C.1. 'Phone: Holborn 4631. [7173

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MORSE KEYS. Morse and Signal, from 4/6; Sounder Buzzers, 5/-. Headphones, 2/6 pair. Bells, best British desk, 2/-. Mains Transformers 3/6. 1 mfd. Condensers, 4d. Telescopes, naval, 15/- and 17/6. Mains Motors, 15/-. 250-watt Dynamos, 25/-.

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This is a splendid pedestal Microphone for speech and music. The bakelite case, containing a 2in. mike and transformer, is on a bronze pedestal (as illustrated). Switch and plug sockets are fitted on the case. It stands unrivalled for quality and price 15/6

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PARCELS of experimental odd coils, magnets, wire chokes, condensers, switches, terminals, etc., post free, 10 lb., 7/-, 7 lb., 5/-. 1,000 other Bargains in New Sale List "W.W."
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FERRANTI M.1, with O.P.M.6c, £5; Varley push-pull output, 12/-; A.F.5c, 19/-.—Wilkinson, 30, Links Av., Monkseaton, Northumberland. [7166

MORSE Printers, complete £2, packing, carriage extra; Hot Wire ampmeters, ½ amp., 2/9, 3/9, postage 3d.—Beatons, Chalk Farm Rd., N.W.1. [7167

VAUXHALL.—Benjamin Class B transformers, 1-1½ to 1, 6/6; Radiophone, Class B, 10/-; volume controls; Radiophone, with switch, 5,000 to 500,000, 3/6.

VAUXHALL.—Set manufacturer's surplus. Skeleton type Westinghouse rectifiers; H.T.8 9/6, H.T.9, H.T.10, 10/-; Westectors, W.4, W.X.6, 5/9; mains transformers, fitted with screened primary, 300-300v. 60 m.a., 4v. 2.5a., 4v. 4a., impregnated windings, 11/6; Niclets, 5/9.

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VAUXHALL.—Dubilier resistances, 1-watt type, 7d. each, all values; Clix valve holders, terminals, 7-pin 9d., 5-pin 7d.; W.B. 5-pin, 4½d.; post paid 2/6 or over, or c.o.d.

VAUXHALL UTILITIES, 163a, Strand, W.C.2; over Denny's the Booksellers. Temple Bar 9338. Send postcard for lists free. [7162

MAGNA 152, with push-pull transformer unit "Monodial," 35/-; B.P. 30 coils, 17/6; 9in. Rola, 17/6, power transformer; list of many others.—Knightbridge, Maldon, Essex. [7125

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RADIO PARCELS Offer 500 Parcels of Guaranteed Useful Components at 3/6 each; each parcel contains 24 articles, and includes assorted resistances, switches, coils, wire, flex, etc., the guaranteed value of each parcel is at least 15/- cost price; satisfaction is assured or money returned; every article in these parcels is brand new and can be used in building modern sets; price 3/6 per parcel (value 15/).—Radio Parcels, 89, Charlotte St., Fitzroy Sq., London, W.1. [7159

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(This advertisement continued on next page.)

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35/-—35 m.m. projector, with automatic rewind, and free non-flam film.

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40/-—16 mm. projector, fitted with motor drive, one only.

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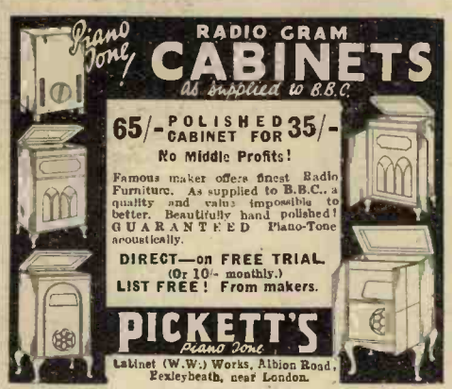
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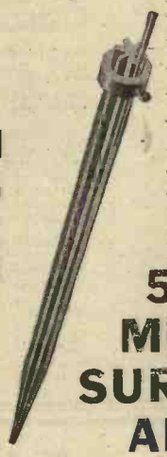

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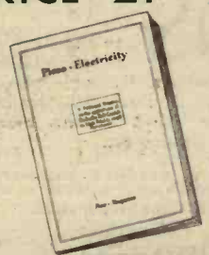

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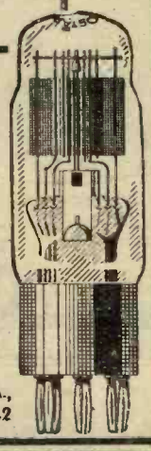

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Covering Every Wireless Interest

Friday, December 14, 1934.

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MURPHY

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(2) the gain of the receiver itself.

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A common method of overcoming this difficulty is to fit what is known as a "local-distant" switch. When this switch is on "local" a resistance is connected in the aerial circuit to reduce the applied voltage, while the "distant" position leaves this resistance out of circuit. The big disadvantage of this, of course, is that it introduces another control and it is not flexible.

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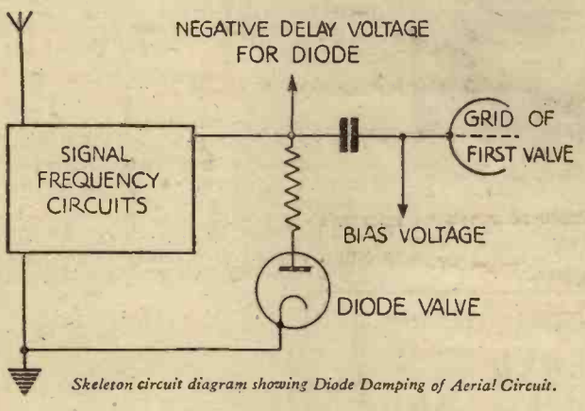

Skeleton circuit diagram showing Diode Damping of Aerial Circuit.

*The goodness of an aerial is measured in terms of its effective height (this is not the physical height but is a mathematical conception in which it is compared with a standard frame aerial), and a good average aerial has a height of about three metres.

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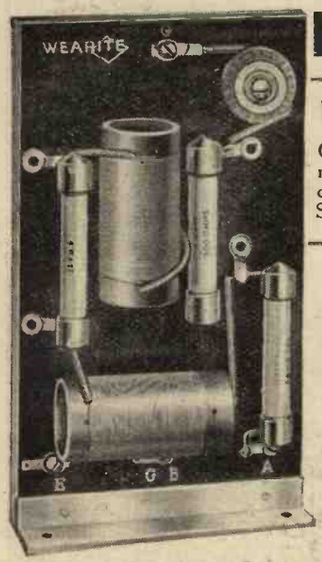

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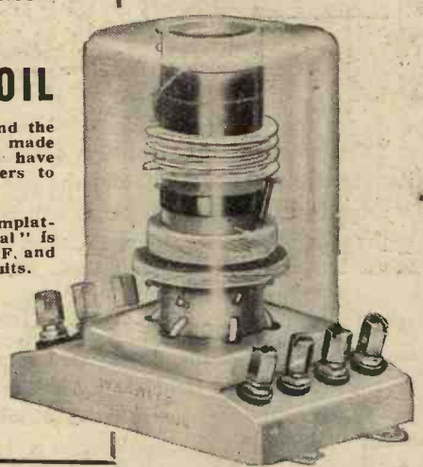

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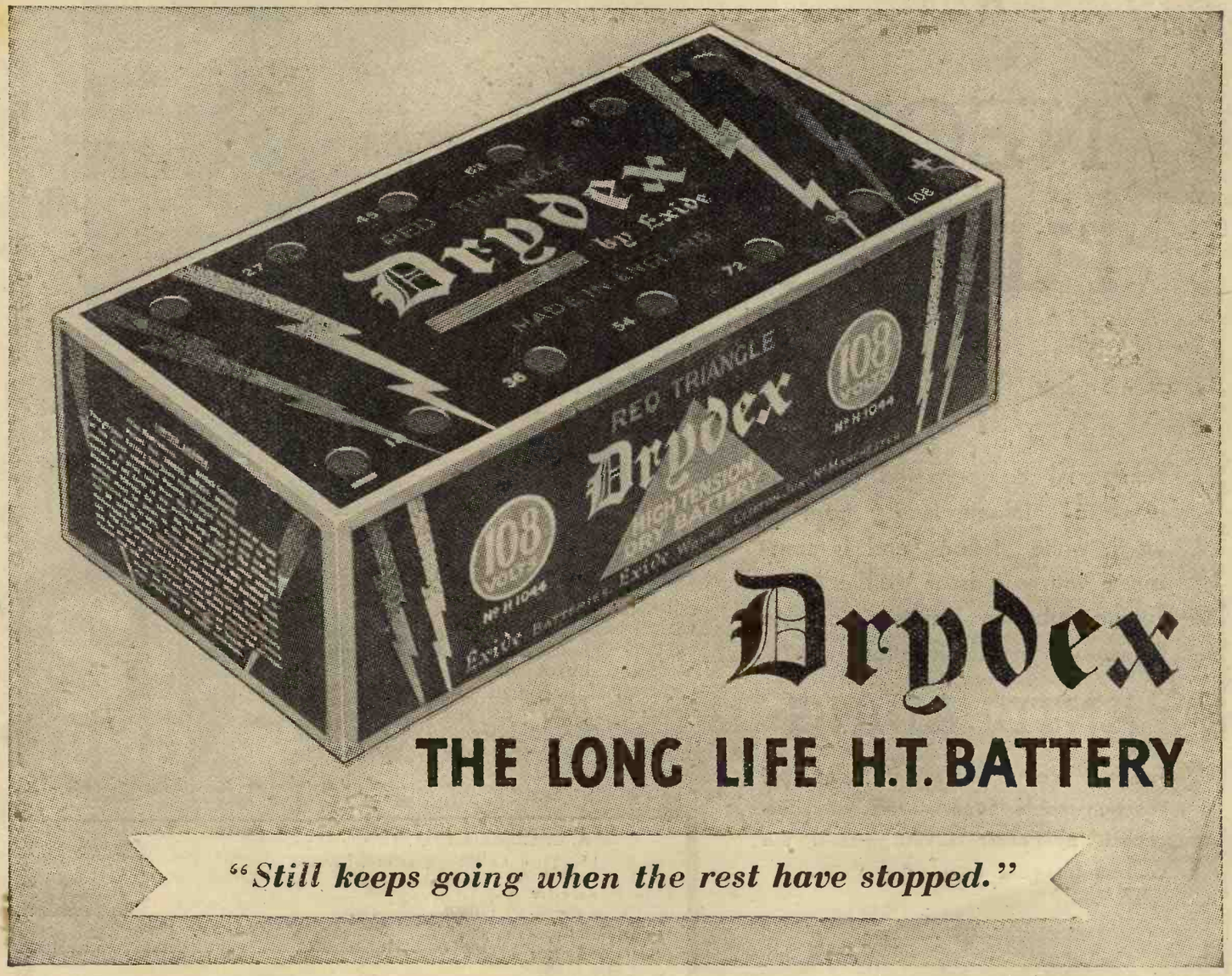

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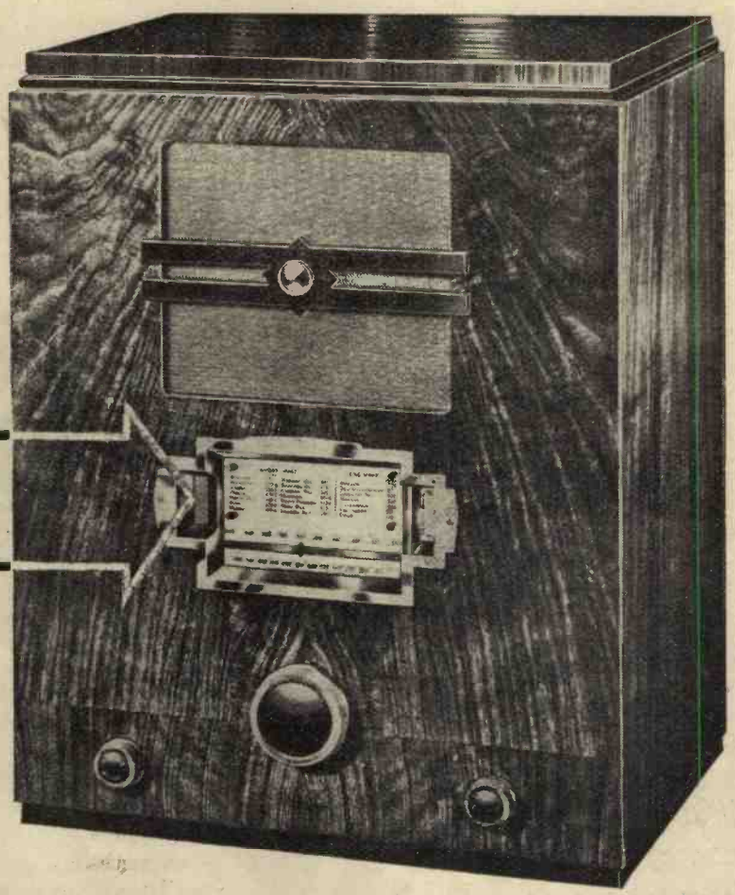

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The Wireless World

THE PRACTICAL RADIO JOURNAL

24th Year of Publication

No. 798. FRIDAY, DECEMBER 14TH, 1934. VOL. XXXV. No. 24.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.
Telegrams: "Autocar, Coventry" Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Broadcasting Wavelengths

Will There Be Any Radical Change?

SOME of us are, perhaps, too prone to regard the present allocation of wavelengths for broadcasting as representing finality, forgetting that quite important changes may take place in broadcasting technique which might necessitate a departure from our present views.

An article this week puts forward the suggestion that short wavelengths may eventually come into use for broadcasting purposes, even in substitution of the medium-band wavelengths now commonly regarded as ideal for the purpose. A good many arguments can, of course, be put forward in support of the use of more or less optical wavelengths for broadcast distribution. They would offer a far better solution of the problem of wide range quality transmission and would have some advantages in that their range would be limited and, consequently, provided that these waves were adopted internationally, mutual interference would be largely eliminated.

When television develops it seems almost certain now that it will be on wavelengths of this order and it would obviously be easier to organise television and sound transmissions combined, where both take place on wavelengths of the same order, than with a wide separation such as would exist at present. The design of receivers, too, would be less complicated.

There are, of course, some equally strong objections to the adoption of these wavelengths for general broadcasting purposes. The listener would probably be dissatisfied to find his range of reception limited to his local transmitter, and some countries too would be unwilling to give up a means of propaganda beyond their frontiers. Again, the organisation of broadcasting networks with transmitters linked to one studio would be extremely difficult, but when we consider that these problems have already to be faced in connection with the development of television, it does at least seem possible that if and when they have been solved the idea of sound broadcasting forsaking the present wavelengths is far from being fantastic and may well be considered as a possible development of the future.

Designation of Receivers

Should Type Numbers be Standardised?

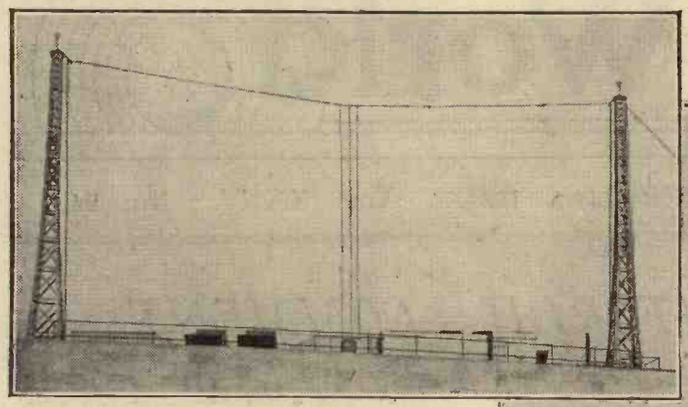
JUST as we have found fault with the lack of standardisation of type designations of valves, so the same objections can be raised, with even greater justification, against the haphazard fashion in which manufacturers of receivers denote their models.

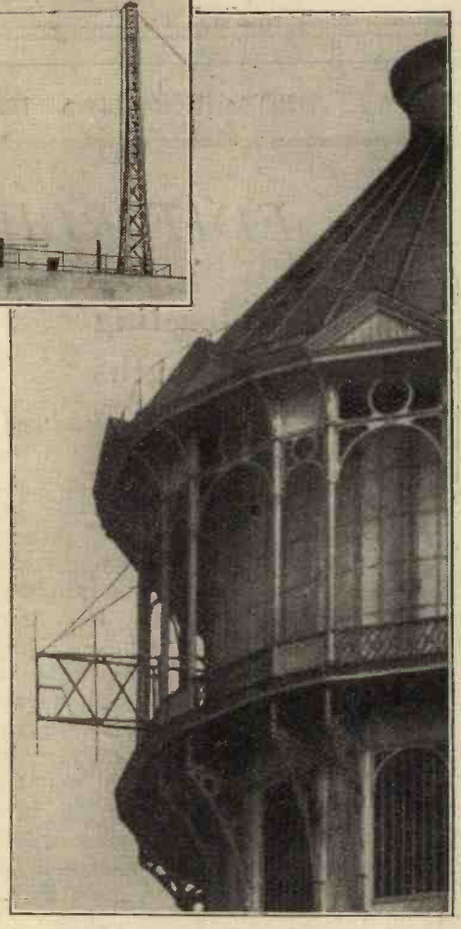
Recently we have seen lists giving current second-hand prices of sets of various vintages. Here is a sample of the information as to the types of sets:—Alba Model 22PM, 1933/34, Climax S4, 1933/34, Columbia Model 1003, 1933/34, Cossor Model 533A, 1932/33 (4 V mains), Cromwell SH8A, 1933/34. It is not necessary to quote any further examples in order to bring home the point that to the average member of the public these type numbers convey little or no information of use regarding the set, even if they may mean something to the manufacturers concerned. The adoption of some system to be agreed upon between manufacturers is obviously overdue.

The Future of Broadcast Transmission

Does It Lie in the Ultra-Short Waves?

By R. W. HALLOWS, M.A.





Two aerials used for ultra-short-wave broadcasting in the London district. Above is the five-metre aerial on Broadcasting House. (Right) The di-pole aerial used by the Baird Company in television experiments at the Crystal Palace.

NO one will dispute that the long and medium wavebands are overcrowded. The author, in suggesting the ultra-short waves as a panacea for interference troubles, advances some interesting arguments in their favour at the expense of the other wavebands, not only in regard to television but on the score of simplicity. He considers that each relay station in a network could be limited in power to 0.5 kilowatt.

AT the present time three bands of wavelengths are used for broadcasting. For what we may call the internal services—that is, those intended chiefly for reception by dwellers within a country's own borders—the medium and the long waves are employed, the actual wavelengths lying between 200 and a little less than 2,000 metres. For external broadcasts intended to serve Dominions, Colonies, or foreign possessions, the short waves are used, the wavelengths lying between 12 and 100 metres and varying according to the time, the season, and the direction in which it is intended to "focus" the transmission. To anyone who seriously considers the present position of internal broadcasting, it must, I think, be clear that, even for the transmission of sound alone, the medium and long wavelengths are already being used to their fullest capacity. One may go further and say that they are overcrowded.

No Room for Expansion

Under the Lucerne Plan, Europe has spaced out its broadcasting stations on a nominal 9-kilocycle basis. By the use of group wavelengths it has been possible to fit something over two hundred and thirty stations into one hundred and thirty available channels. But the Plan, well as it is working in comparison with the chaos that prevailed before it came into operation, allows no room for further expansion; it is difficult, in fact, to see how it can make provision for not a few stations that are now either projected or in course of construction.

In America the problem of overcrowding is almost more acute. The United States has adopted a 10-kilocycle separation, and by careful geographical grouping and the assignment of certain wavelengths to different stations at different hours it has been found possible to fit more than five hundred stations into the medium waveband between 200 and 550 metres.

Were there no other countries but the United States in the American Continent all might be well. Actually no small amount of interference is experienced from stations in Canada, South America, and the island countries.

The wide adoption of high power on both sides of the Atlantic has produced certain quite unexpected results. Not the least important of these is the production of "ghost" signals, a matter which was dealt with by Dr. van der Pol at the recent Radio Conference in London. Briefly it has been found that when a high-powered station with a wavelength above about 470 metres is transmitting, its signals may be superimposed upon those of other stations using shorter wavelengths, provided that these and the station causing interference lie more or less in a straight line with the receiving aerial.

Many readers must have found Luxembourg appearing at times as a background to Beromünster and other stations. Dr. van der Pol predicted that when the Droitwich station began to transmit its signals would be heard in Holland as ghosts behind Athlone's, and this was duly found to be the case.

New Set of Problems

Harmonics of powerful long-wave stations, and those using medium waves above 400 metres, provide another problem, for these can cause very serious interference. In theory there were 130 channels available when those who drew up the Lucerne Plan began their work; in practice interference from ghost signals or harmonics has considerably reduced this number.

Again, we have to realise that neither a 9-kilocycle separation nor even one of 10 kilocycles is sufficient to allow perfect reception of broadcast programmes to be obtained except at comparatively short range, where the spread of a local station is such as to ensure that a good receiving set can do full justice to the transmissions. Even if receiving sets are selective enough to separate the unmodulated carrier waves of stations working with a 9-kilocycle separation, they can, in the light of our present knowledge, do nothing to counteract that unpleasant phenomenon known as sideband splash when one or other of the pair is transmitting speech.

Thus, if we review the position from the point of view of the transmission of sound alone it is far from ideal. But television is knocking at the door, and here an entirely new set of problems arises. So long as television is limited to the wavelengths of the medium band it can never possess anything approach-

The Future of Broadcast Transmission—

ing genuine entertainment value, for it cannot go beyond the low-definition 30-line process. And even 30-line television with an image of the shape now generally used requires actually a total sideband width of 27 kilocycles, or three "Lucerne channels."

Those who have witnessed demonstrations of high-definition television by the 180-line process with an image of cinematograph film shape, must admit that it is so good that there is no questioning its entertainment value. The most important technical problems have been solved; there could, in fact, be full television services to-day by the high-definition process if only there were space for them on the wavebands used for broadcasting. But such high-definition television demands an astounding amount of elbow room. The total sideband width is found by multiplying the number of pictures per second by the square of the number of scanning lines, and multiplying this again by the ratio between the longer and the shorter side of the picture. If we are to transmit 25 pictures a second with 180-line scanning, and a length-to-depth ratio of 4 to 3, the total spread works out at almost astronomical figures.

Advantages of "Ultra-shorts"

It is clear, then, that there is no possibility of developing high-definition television upon the medium waveband, whilst the whole of the long waveband would be hopelessly inadequate to accommodate a single high-definition television transmission.

There is only one region in which space can be found for high-definition transmissions, and this is on the ultra-short wavelengths well below 10 metres. The experimental work hitherto conducted has been done mainly on wavelengths in the neighbourhood of 7 metres. For a long time these ultra-short waves were regarded as useless for any wireless purposes. Recent discoveries by Senatore Marconi and others have shown that so far from being useless the ultra-short waves have many outstanding advantages over the shorts, the mediums and the longs for certain purposes.

Amongst their advantages may be mentioned complete freedom from fading and from atmospheric interference. On the other hand, so far as we know at present, the range at which reception can take place is visual or quasi-visual. That is to say, the receiver must be visible from the transmitting aerial, or, at any rate, very little below the horizon.

In one respect this is a drawback, since the limited range means that it is not possible for a single station using the ultra-short wavelengths to cover a very wide service area. But considered from another angle this is by no means so great a disadvantage as at first sight it might appear to be.

On the medium and long waves much of the interference from which we suffer is caused by long-range interference between stations. Heterodynes between transmitters situated well over 1,000 miles apart were not unknown last winter, and during the coming months I shall be surprised if WLW and other giant stations in the United States do not cause interference with European stations late in the evening.

If the ultra-short waves are eventually found to behave generally in much the same way as light waves, two stations, say, a hundred miles apart, could send out different transmissions on the same wavelength without causing mutual interference. It is, though, quite within the bounds of possibility that the ultra-short waves may turn out to have enormous skip areas and that transmissions made upon them, though inaudible for great distances surrounding the transmitter, may reappear at points still farther away, owing to the action of a reflecting layer beyond the Appleton.

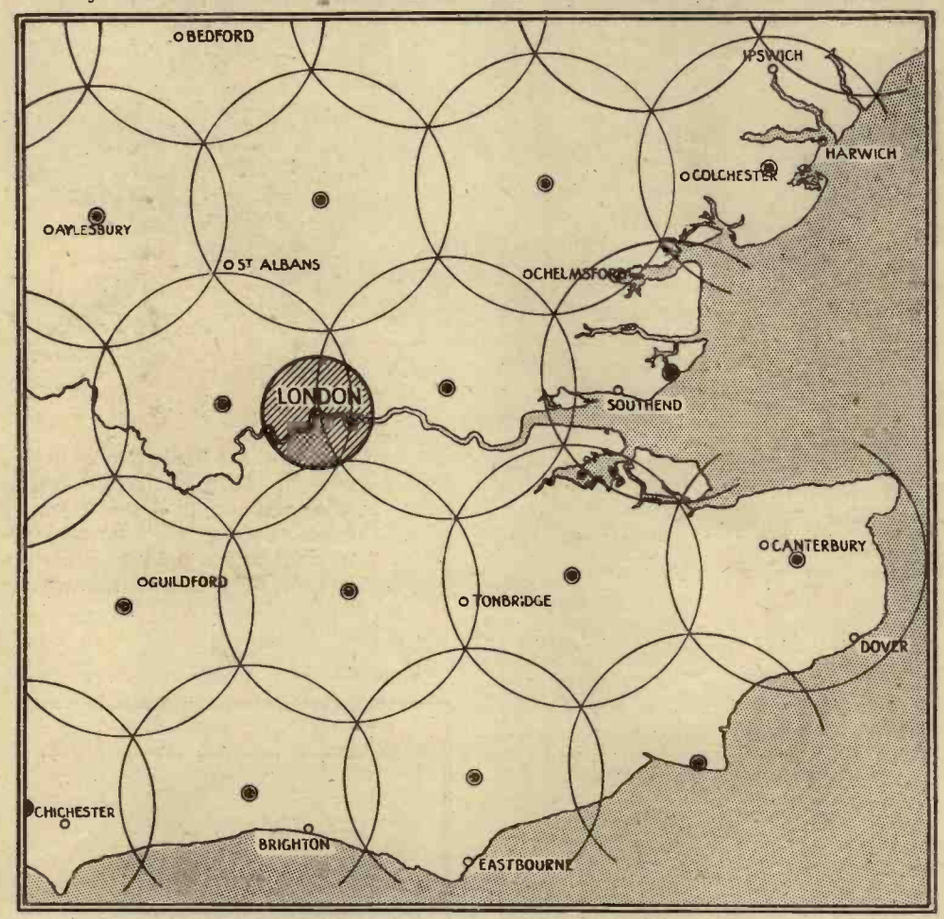
In any case, the use of ultra-short wavelengths would seem, on the face of it, to provide a possible solution of many of our most pressing problems. Though giant stations with huge service areas are impracticable, a country could be served by a network of relay stations, each with an output power no greater than 0.5 kilowatt.

It was estimated recently that five hundred such stations would be required to cover the United States of America. For our own country it seems probable that a hundred or less might suffice. Each of them could transmit sound upon one channel and vision upon another. The combined sound and vision receiving apparatus would contain in the same cabinet separate receivers for sound and vision.

Certainly, the future of high-definition television lies upon the short waves, and television must be so intimately associated with the broadcasting of sound that a network system of the kind suggested seems, from many points of view, to offer the most satisfactory way out of a multiplicity of difficulties.

It was pointed out recently in *The Wireless World* that on the ultra-short waves the number of available channels is by no means so great as at first sight it might appear to be. Crystal control cannot be applied to ultra-short wave transmitters, and there must be a certain amount of wobble. The band of frequencies available between, say, 5 and 8 metres is, however, so gigantic in extent that there would appear to be room for every transmitting station, both for vision and for sound, that the world can possibly want for a good many years to come, particularly if it is found, as a result of further experiments, that the geographical separation of stations using the same ultra-short wavelength can ensure the complete absence of mutual interference.

My own belief is that in ten years or less the majority of internal broadcasting will be done upon the ultra-short wavelengths.



At least a score of ultra-short-wave transmitters having an average reliable range of 15 miles would be required to cover the Home Counties.

The Wireless World

New Single-Span Battery Four

Constructing, Testing and Operating an Economical Superhet Receiver

By W. T. COCKING

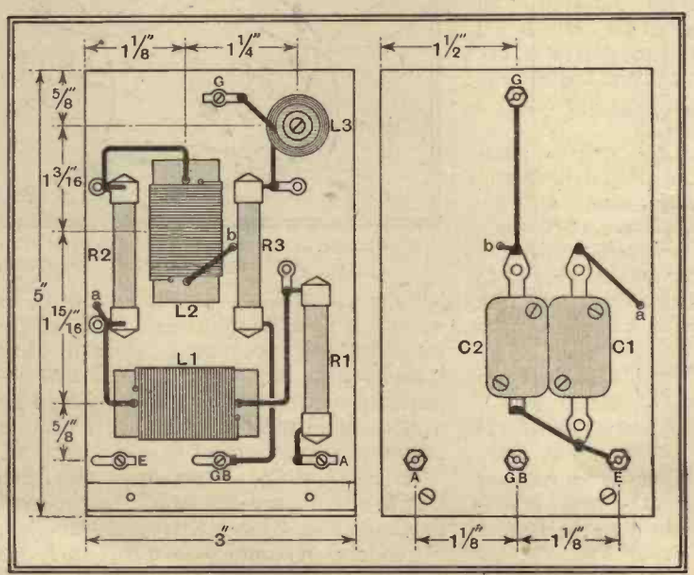
(Concluded from page 457 of Dec. 7th issue)

THE theoretical side of this receiver was discussed last week, and in this article the construction is fully dealt with in addition to the initial adjustments; and complete wiring diagrams are included.

THE details of the circuit of the new receiver were very fully considered in last week's issue of *The Wireless World*, but it is felt that some further notes on the pre-detector volume control may be advisable since the reason for the particular form which the control takes may not be at all apparent. Since both the frequency-changer and the IF valve have variable-mu characteristics it would seem natural to control volume by varying their grid bias. This form of control would be necessary if the pre-detector control were the only volume control, but in this set there are both reaction and an LF potentiometer for varying the sensitivity. These two give an adequate control of volume for all but strong stations, so that the pre-detector control need have only a small range, and becomes not unlike a local-distance switch in its function.

This does not explain why a bias control is not used, and the reason is bound up with the linearity of the valves. If the IF valve were controlled the operation of reaction would be seriously affected, and quite a small increase of bias would render it non-operative. Although this would be unimportant for local reception, it may sometimes be necessary to use the volume control on other stations for which reaction may be needed to increase selectivity.

The control could be arranged to bias the control grid of the heptode negatively, but it has been found inadvisable to do this. Single-span tuning depends for its success upon the use of a frequency-changer which does not produce beats between voltages of different frequencies applied to the *control grid*, but only between these voltages and one injected by means of another electrode; in other words, only between signal and oscillator frequencies. If a frequency-changer of this type were not obtainable single-span tuning would hardly be practicable, for any and every pair of stations the sum of the frequencies of which equalled the intermediate frequency would give interference. The conventional two-valve frequency-changer, therefore, or its equivalent the triode-pentode, is thus quite unsuitable.



The construction and wiring of the aerial filter unit can clearly be seen in this drawing.

In the case of the heptode, the octode, and the triode-hexode, frequency-changing does not depend upon any non-linearity between the control grid and anode, and if the valve is here linear no beats between signal frequencies need occur. The degree of linearity obtainable with present valves depends upon the bias applied to the control grid and, as usual with variable-

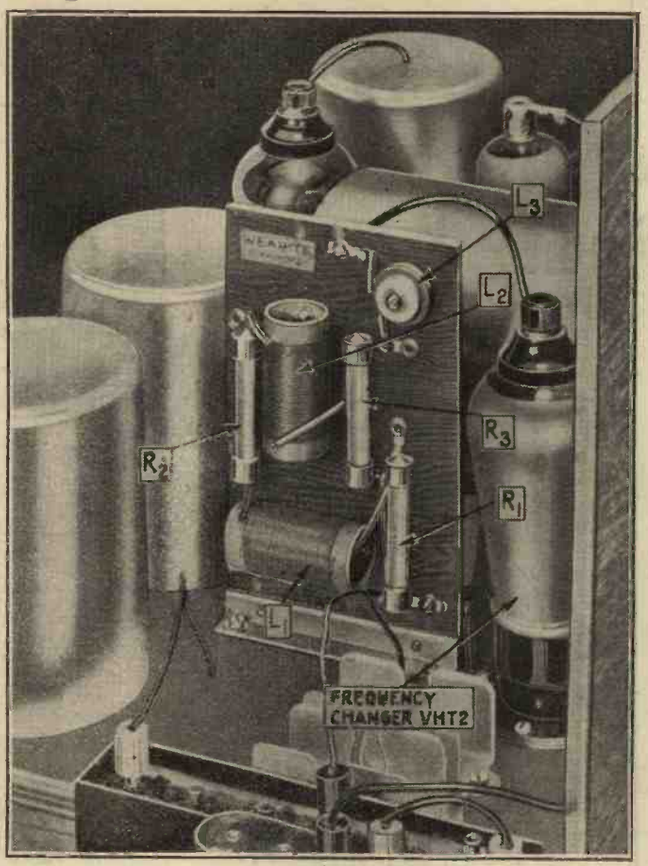
New Single-Span Battery Four—

mu valves, it is at its greatest when the bias is at a minimum. The bias, therefore, should be no greater than is necessary for the avoidance of grid current, and in the case of a battery valve this is zero bias. Now even the most linear valve has its overload point, and in the case of a heptode it is quite small, and the departure from linearity is sufficient to cause trouble when the input exceeds about 0.25 volt. The normal input is below this figure, but it obviously varies in different localities and according to the efficiency of the aerial employed. When negative bias is applied, the input handling capacity is reduced, so that it becomes inadvisable to control volume in this way. The control used, therefore, acts by reducing the input to the first valve.

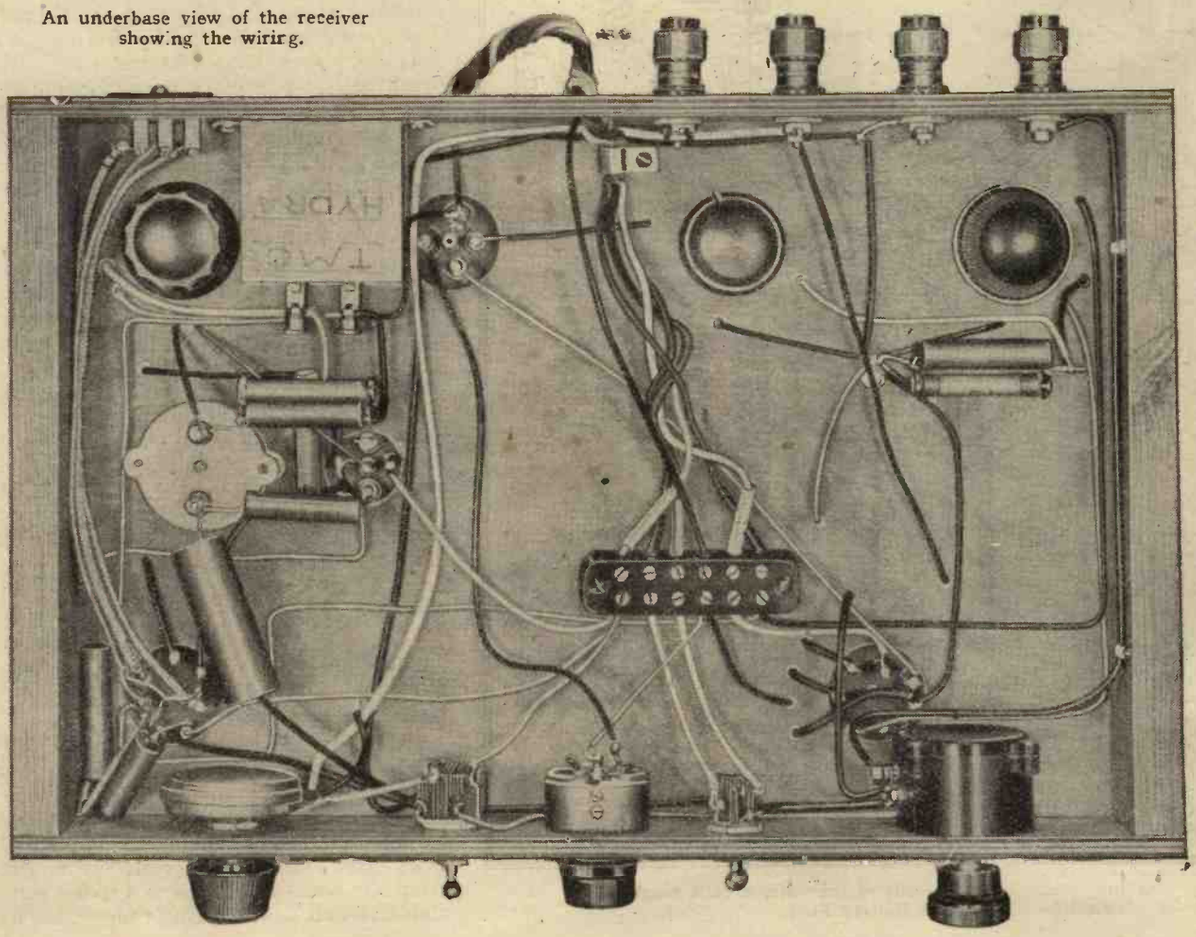
Turning now to the mechanical side of the receiver, the apparatus is assembled on a chassis built from a piece of aluminium-covered plywood supported by wooden battens. No points of special importance arise in connection with the actual construction, except in the case of the IF transformers and the tuning unit, and full details can be gleaned from the drawings and photographs which accompany this article.

Each IF transformer consists of a screening can, an air-dielectric trimming condenser, and a coil. The coils can be obtained ready made, or they can be built according to the details given in one of the drawings. In this connection, it should be noted that the different windings must be separated by two layers of thin paper. The condenser should be mounted on the base of the screening can and the fixing nut securely tightened. The chassis has a clearance hole for this nut, and the screen is secured to it by means of three wood screws. The appropriate coil is now mounted on the condenser by securing the bracket under the terminal for the *moving* plates.

In the case of the oscillator coil assembly it is necessary to drill a hole in the base of the screen to clear a projecting bolt on the dial. The tuning condenser, screen base, and mounting bracket are secured by the one-hole fixing bush of the condenser and the compression condenser is fixed by two small brackets. The coil is mounted on the frame of the condenser by two 6 BA bolts, and the oscillator grid leak and condenser are supported by the wiring. In making this unit, care should be taken to see that nothing fouls the screening can, and points which require especial watching are the terminals of the compression condenser. Should a short-circuit to the can occur, it is improbable that the receiver will function.



The position of the aerial filter in relation to the components is clear from this photograph.

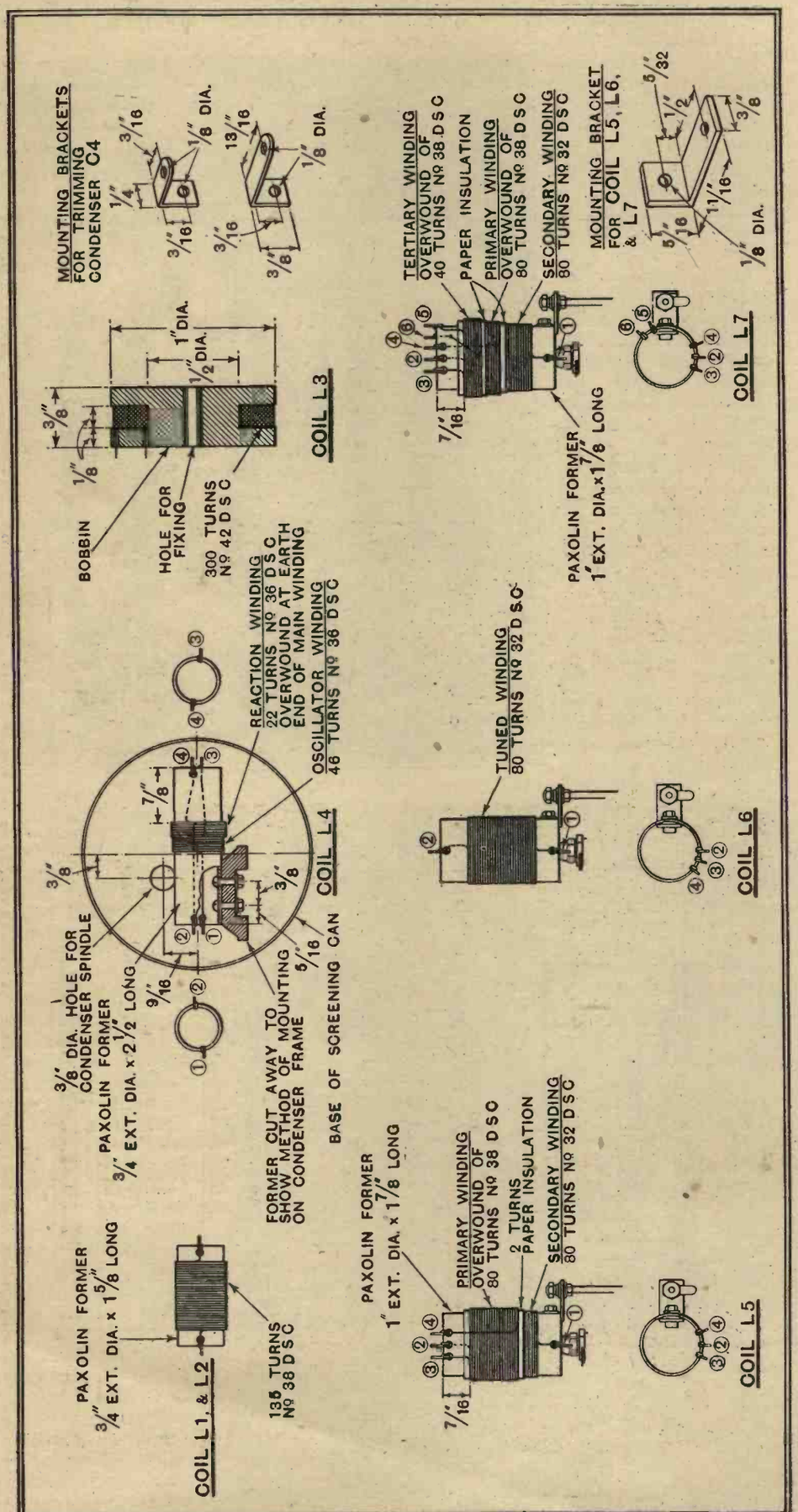


An underbase view of the receiver showing the wiring.

The aerial filter, if it is not obtained ready made, can readily be assembled by mounting the components on a small Paxolin panel. It is particularly important that the two condensers C1 and C2 should be within plus or minus 5 per cent. of their rated capacity. Most manufacturers can supply condensers within this tolerance for a small extra charge. The ordinary rating allows for errors up to 15 per cent., and this is sufficient seriously to affect the filter characteristics. For the same reason the coils should be carefully wound.

When carrying out the wiring care

CONSTRUCTING THE COILS


MOUNTING BRACKETS FOR TRIMMING CONDENSER C4
3/16
1/4
3/16
1/8 DIA.
13/16
3/16
1/8 DIA.
3/8
COIL L3
1" DIA.
1/2" DIA.
3/8"
1/8"
BOBBIN
HOLE FOR FIXING
300 TURNS No 42 D S C
REACTION WINDING 22 TURNS No 36 D S C OVERWOUND AT EARTH END OF MAIN WINDING
OSCILLATOR WINDING 46 TURNS No 36 D S C
COIL L4
3/8" DIA. HOLE FOR CONDENSER SPINDLE
PAXOLIN FORMER 3/4" EXT. DIA. x 2 1/2" LONG
7/8"
3/8"
3/8"
9/16"
5/16"
FORMER CUT AWAY TO SHOW METHOD OF MOUNTING ON CONDENSER FRAME
BASE OF SCREENING CAN
PAXOLIN FORMER 3/4" EXT. DIA. x 1 5/8" LONG
135 TURNS No 38 D S C
COIL L1, & L2
PAXOLIN FORMER 1" EXT. DIA. x 1 7/8" LONG
PRIMARY WINDING OVERWOUND OF 80 TURNS No 38 D S C
2 TURNS PAPER INSULATION
SECONDARY WINDING 80 TURNS No 32 D S C
7/16"
COIL L5
TUNED WINDING 80 TURNS No 32 D S C
COIL L6
TERTIARY WINDING OVERWOUND OF 40 TURNS No 38 D S C
PAPER INSULATION
PRIMARY WINDING OVERWOUND OF 80 TURNS No 38 D S C
SECONDARY WINDING 80 TURNS No 32 D S C
7/16"
PAXOLIN FORMER 1" EXT. DIA. x 1 7/8" LONG
MOUNTING BRACKET FOR COIL L5, L6, & L7
5/32"
1/2"
3/8"
11/16"
5/16"
1/8 DIA.
COIL L7

These drawings give full constructional details of the various coils employed in the New Single-Span Battery Four.

should be exercised to keep important leads well separated. It is not always realised that it is not sufficient merely to connect the points indicated on the diagrams, for the physical positions of the wires often exercise a marked effect. It is true that the receiver will probably function, and DC tests indicate nothing amiss, however the wiring may be carried out, but the performance may leave much to be desired. This is fairly obvious when the stray couplings manifest themselves as instability, but it is quite possible for such couplings to have the opposite effect, and the only symptoms are then low sensitivity and selectivity. In these days of screened components between which little interaction occurs, it often seems that great liberties in layout can be taken. This is not the case, however, for the wiring can rarely be conveniently screened in an efficient manner, and alterations in the layout of components are reflected in the wiring, often with disastrous results. As far as possible, therefore, the wiring must be carried out in the manner of the original receiver, as shown by the various photographs and drawings.

Adjusting the Receiver

When first setting up the receiver it is a-wise plan to check over the voltages and currents to make sure that they are reasonably in accordance with the figures given in the table. The batteries should be in good condition, and 150 volts applied to the anodes of all valves, 70 volts to the screen of the heptode, and 60 volts to the oscillator anode and IF valve screen grid. The output valve should be given a grid bias of −10.5 volts and the LF valve −1.5 volts. For LT a 2-volt accummulator must be used, and as the total current consumption is 0.85 ampere, the cell should have an actual capacity of at least 20ah. Although the receiver will function with an HT supply lower than 150 volts, both the sensitivity and output will be reduced, so that such supplies are not recommended nor is an HT eliminator.

The initial adjustments consist of lining up the three IF circuits to resonate exactly at some frequency close to 1,600 kc/s and adjusting the oscillator padding condenser for the correct tuning range. The condensers C6, C7, C10 should be set at maximum with their vanes fully enmeshed and pencil marks made on the under side of the base opposite the pointers on the controlling knobs. Taking these marks as 180° on an imaginary scale, rotate each knob in an anti-clockwise direction until C6 is set at 120°, C7 at 100°, and C10 at 100°. The three circuits will now be tuned approximately to 1,600 kc/s. Next screw up C4 fully and unscrew it one complete turn.

It should now be possible to tune in a signal, and the weakest station audible with reaction at minimum should be tuned in. Then carefully adjust each IF trimmer for maximum signal strength. The selectivity and sensitivity depend upon the accuracy with which this is carried out, and it is well worth taking some pains to

New Single-Span Battery Four—

A full-size blue print of the wiring diagram is available from the publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. post free.

get each circuit tuned exactly. The ear is a notoriously poor indicator of signal strength, hence the recommendation to use a weak signal for trimming.

The only circuit in which there is a change of direct current with signal strength is the detector, and this is unfortunately too small to be detected with anything but a sensitive microammeter. It is possible by means of an artifice to use a milliammeter as a resonance indicator, however. The meter should be of a low range type, and be connected in the anode circuit of the LF valve in series with R10. The anode current of this valve does not normally vary with signal strength, but it will do so if the wander plug be withdrawn from the −1.5 volts socket of the bias battery and C11 be short-circuited. Under these conditions the current with no signal is likely to be above normal, and the amplification may fall and distortion appear. No notice should be taken of this, however, and attention should be concentrated upon obtaining correct trimming, which must be carried out for a minimum reading on the meter. A fairly strong signal will probably be best when using a meter, but even then the change of current is unlikely to be very large, so that care is necessary.

Final Adjustments

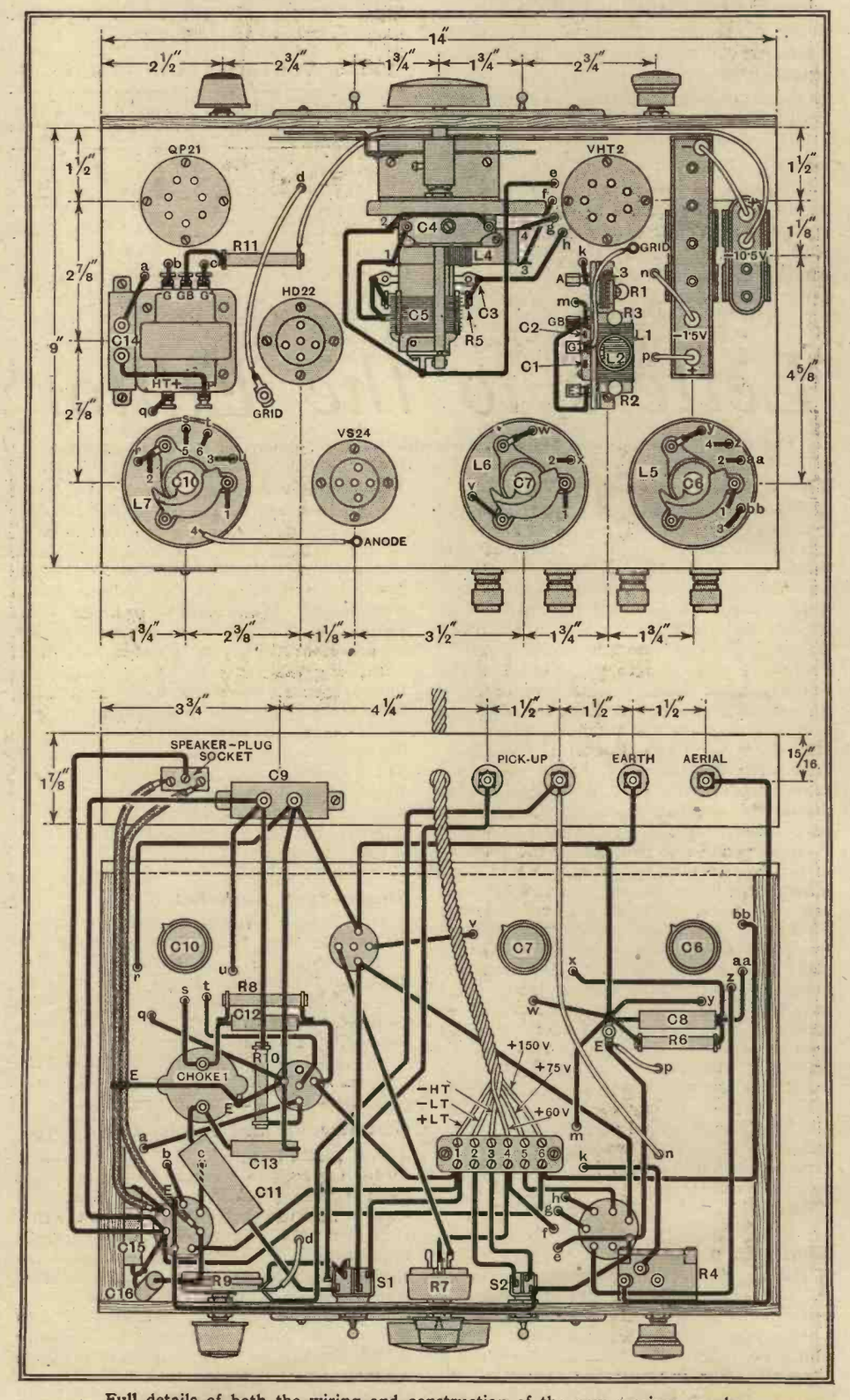
The reaction control must be kept at minimum, otherwise the trimming cannot be carried out in the correct manner. It is interesting to note that trimming with reaction leads to reduced selectivity. When satisfied with the trimming the meter should be removed, the wander plug replaced in the battery, and the short-circuit on C11 removed.

The receiver should now be found to function properly, and adjustment to C4 will be necessary only if the tuning range is incorrect. If it be found that the dial settings for all stations are rather high C4 should be screwed up a little. On the other hand, if the dial settings are low, C4 must be unscrewed. Adjusting this condenser will only move the dial settings in the same direction, so that it cannot be used to correct for a case where dial settings are high at the low end of the scale and low at the high end. This will occur if the intermediate frequency circuits have been lined up at a frequency higher than 1,600 kc/s. The remedy is to reduce the intermediate frequency by increasing the capacity of all three IF trimmers; the process of adjusting these circuits, of course, must be gone through afresh.

The reaction resistance has been so chosen that self-oscillation occurs when about one-half the resistance is in circuit in order to allow for variations between valves and for falling battery voltages. It will be found that if a station be tuned in without reaction, and the control then advanced, no increase in signal strength will occur, in fact, a station on an adjacent channel may appear. This is because the application of reaction affects the tuning slightly, but this will cause no difficulty if it be remembered that an alteration in the setting of the reaction control must be accompanied by a very slight change in dial setting.

Where interference and the strength of the signal permit, the best reproduction will be secured with the pre-detector control R4 set at a maximum, reaction at minimum, and the LF volume control set to give the desired volume. If distortion be found in local reception, then R4 should be brought into play. When interference is not severe, but signal strength is low, both R4 and R9 should be set for maximum

SIMPLIFIED WIRING



Full details of both the wiring and construction of the new receiver can be gleaned from the drawings.

New Single-Span Battery Four—

volume, and the sensitivity brought up to the required level by the application of reaction. In cases where the signal strength is sufficient without full reaction but the station is suffering from interference, the volume control R9 should be reduced until the interference is only just audible, and the signal strength brought back again by increasing reaction while retuning slightly.

The receiver gave a very good account of itself when tested in London with an aerial of average efficiency. The sensitivity proved adequate for general distant listening, and stations such as North Regional, Cologne, Brussels, Paris, etc., could be relied upon in daylight. The selectivity was high enough for the reception of all important stations, and its degree may be judged when it is said that it proved just possible in daylight to receive Cologne clear of North Regional and Radio-Paris free from Droitwich. The quality of reproduction was of a high order, and did not deteriorate greatly with the application of reaction until it was pushed to the limit set by the appearance of instability, while the volume proved adequate for most domestic purposes.

It was mentioned earlier that some adjustment might be necessary on gramophone owing to the high frequency response being better than is necessary. If it be found, therefore, that reproduction is too high pitched, the pick-up should be shunted by a resistance of moderate value. The correct value should be found experimentally, but will usually lie around 50,000 ohms to 100,000 ohms.

VALVE VOLTAGES AND CURRENTS

Valve	Anode Volts	Screen Volts	Grid Bias	Anode Current	Screen Current
Frequency-Change.				mA.	mA.
VHT2 tet....	150	68	0	0.7	1.0
osc.	55	—	—	0.7	—
IF V824 ...	150	55	0	2.25	0.2
LF HD22 ...	110	—	− 1.5	1.5	—
Out. QP21...	150	150	−10.4	3.0	2.85

Total Current = 12.2 mA.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

The Art of Listening

I WAS very pleased to read your Editorial of October 19th. The public have much too much to say in the choice of programmes. Listening to music is an art, and the question of how to get the best value from it has been carefully studied by experts such as Mr. Percy Scholes. Through following their advice thousands of music lovers are now able to enjoy some of the finest things in music which otherwise would have remained a closed book for them.

It is absurd for the public to think that they know what they want. It is no more reasonable for them to choose their own music programmes than it is for them to decide the nation's economic policy, since they know very little of either.

Now anyone who has studied the question of listening to music will tell you that good music must be heard several times before it can be really appreciated or enjoyed. Therefore, repetition in programmes is essential—repetition at intervals sufficiently short to prevent the earlier impressions being forgotten. But, as you justly point out, we hardly ever have this repetition—certainly never with the more difficult modern works which need it most of all. Naturally the demand for good music is small. It just never gets a fair chance.

Let us have plenty of good music and plenty of repetition of selected works, new and old. And when we begin to know a little about music, then let us choose our own programmes. M. H.

Cairo.

What's in a Name ?

THE article in the November 23rd issue was very amusing, but I think the writer will find, if he examines the question a little closer, that some of the nomenclature which he ridicules is not quite so stupid after all. For example, he says, "Could one seriously go to the Motor Show to see the latest models of 'horse-eliminator'? "

I suggest it would be a very good thing if we did look at the matter from this point of view. Suppose we got into the habit of calling a large power station a "million humans-eliminator," would it not bring home to us just what that power station was doing? We would then look on the problem of unemployment not as a growth to be removed, but as a natural result of harnessing the forces of Nature to displace human labour. We would solve the problem by making it possible to distribute the products of the machine instead of trying to discover fresh jobs to be done by humans. These considerations are, of course, nothing to do with "wireless," but they seem to arise out of the article to which I have referred. A. W. JOSEPH.

Edgbaston, Birmingham.

Single-Span Superhet

I HAVE built a radio-gramophone employing the first Single-Span superhet circuit described in your April issue of *The Wireless World*, and I am pleased to be able to say that the results leave little to be desired in so far as DX, reproduction and simplicity of control are concerned.

DENNIS E. NIXEY.

Wandsworth Common, S.W.

Commercial and Service Operating

I AM pleased to note that Mr. Milne has been gracious enough to concede his point regarding R.A.F. operators, and would suggest that the probable reason for the fact that few replies have been forthcoming in opposition to his views is that members of the Services would not be permitted to enter into a public discussion on the matter.

Mr. Milne is obviously ill-informed as to the circumstances and conditions under which the various apparatus he criticises is controlled and operated, and I would submit that the equipment of commercial and public utility services would not have been brought into a controversy on "The Question of Quality."

However, it should be borne in mind that the design and installation of commercial apparatus is the privilege, invariably, of one of the three leading wireless manufacturers in Great Britain. Such being the case, we may be assured that the equipment is the best possible for any individual requirements. Our commercial operators, too, rank among the finest in the world.

In conclusion, may I point out that, whilst an intensive training will provide the necessary grounding and theoretical knowledge, practice and experience is essential to good operating.

CHARLES L. McALLISTER.

Beckenham, Kent.

Radio-minded Household

WHILST agreeing that Mr. Richard Arbib has put up an excellent defence for his radio-equipped house, may I say that it is not the convenience of switches and loud speakers in many rooms to which I object, but the general outlook which seems to underlie the whole arrangement. Mr. Arbib has, however, quelled certain of my fears with regard to him personally and to his household in general.

With his statement that it is possible to listen to radio whilst doing other things I disagree absolutely, omitting, of course, certain mechanical or semi-mechanical actions such as stringing beads, knitting or sewing. There are, of course, extraordinary individuals, such as my mathematical friend mentioned in my first letter; but close questioning has elicited from him that he does not really listen to the radio, and has really no idea at all what has been going on while he is working. He confesses it is a bad habit, like his other one of smoking continually.

No ordinary person can read a book intelligently, carry on a proper conversation, play bridge as it should be played, or do anything which requires concentration for proper achievement, whilst really listening to radio.

That it is possible to work, and work well, in conditions of noise I cannot deny from my own personal experience, but I do know that good work, or, for that matter, good play, is far more exhausting when there is a background of noise than when there is quietness.

I am quite ready to believe that Mr. Arbib has a better brain than I have—that is, he can concentrate better—but if he persists in taking his leisure, as presumably he must take his work, to a background of considerable noise, he may end up, by the time he is fifty, with a brain incapable of doing any real work at all.

ERNEST H. ROBINSON.

Pirbright, Surrey.

Time Signal Receiver

I SHOULD be very much obliged if some of your many readers would give me information about a suitable circuit for a receiving set for the reception of time signals (Greenwich if possible) in Newfoundland by the Public Schools Exploring Society.

Conditions for reception will be bad, i.e., in the depths of the forest. The set will have to be as compact, light and robust as possible, as it will have to be carried on someone's back.

C. A. CARKEET-JAMES,
Capt. R.A.

R.A. Mess,
Woolwich.

The Haynes Quality Amplifier

New Exclusive Features—Matched Intervalve Coupling and Harmonic Free Output.

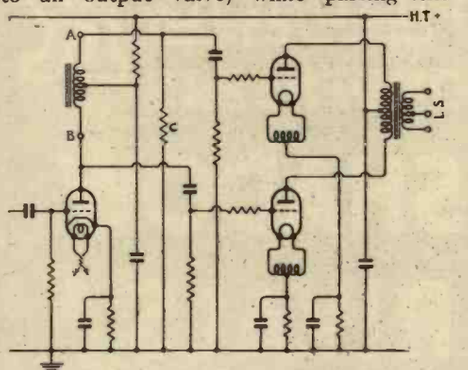
By F. H. HAYNES.

DUOPHASE amplifier-eliminators used with all Haynes receivers embody the following two important features.

(1) *The intervalve coupling.* In order to produce the required phase reversal for working a pair of opposed output valves a choke is inserted in the anode circuit of the small power valve used in the first L.F. stage. The customary "infinite impedance" intervalve coupling is necessarily avoided owing to its high leakage which with an excessive self-capacity gives rise to resonance in the upper part of the frequency range. Instead, a coupling is employed which is loaded and matched to the valve used in the penultimate stage. This valve thus works into a reactive load of definite value, the coupling inductance being compact, avoiding the undesirable effects of leakage inductance.

This new form of intervalve coupling cannot be resistance fed, while if a choke feed were to be adopted a large anode inductance would be needed having a gapped core, thus bringing about the danger of hum by linkage with the A.C. mains equipment of the eliminator. To avoid this the phase reversing choke is connected directly into the anode lead and here an entirely new circuit system is introduced.

As the comparatively heavy anode current would readily produce saturation of the small iron core of the choke a *demagnetising winding which is also the phase reversing winding* is closely interwoven with that section of the choke feeding current to the anode of the valve. In addition this demagnetising winding is taken to the H.T. negative through a resistance (C) which serves the *dual* purpose of providing a correctly matched load for the valve (just as a loud speaker is matched to an output valve) while passing the



necessary current through the choke so that no D.C. potential exists across the points (A) and (B). Here we have an intervalve coupling matched to its valve and practically devoid of the evils of leakage inductance and self-capacity. As there is negligible D.C. magnetising current, advantage may be taken of the merits of a compact nickel-iron core in the construction of the choke. Precise balancing of the two halves of the choke is readily obtained as compared with the difficulties encountered with the usual highly inductive push-pull intervalve coupling where, owing to lack of balance, correct cancellation of second harmonic distortion—the merit of the push-pull stage—does not result.

(2) *Output valves working in opposite phase.* Correct output matching provides for the lowest value of distortion, which arises in the form of harmonic frequencies. If the stage be overloaded there will be an excessive value of third harmonic distortion with but little second harmonic. If underloaded the third harmonic becomes negligible and there is an increase of power, but there is a rise in the second harmonic content in the output. Haynes amplifiers are designed so that third harmonic distortion is avoided while the second harmonic is extinguished by total cancellation owing to the use of a pair of valves working in correct phase opposition.

Harmonic distortion, even if expressed as only a few per cent., is distinctly objectionable, particularly and as is often the case where the loud speaker diaphragm readily creates frequency doubling.

Full details of Haynes Quality Receivers, Amplifiers, and Loud speakers are given in a free 32-page booklet. Sets are demonstrated every Friday at the Enfield Factory between 7.30 and 9.30 p.m.

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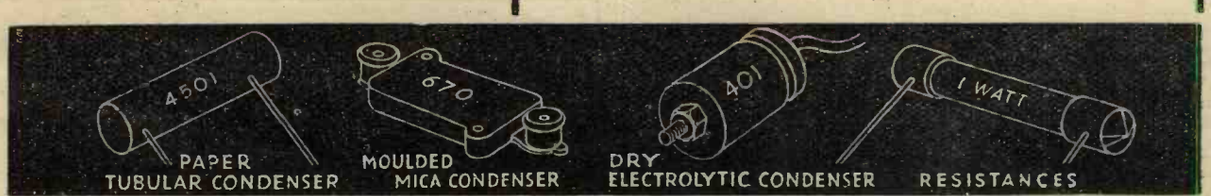


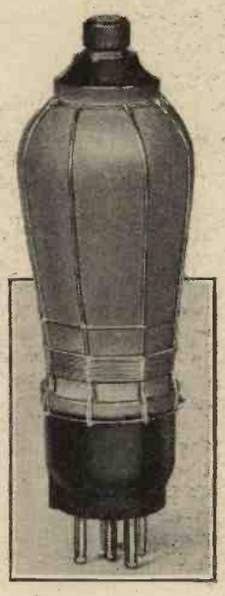
HINTS and TIPS

Practical Aids to Better Reception

ALTHOUGH a valve may continue to work almost indefinitely after the glass bulb has become loose in the base moulding, there is always the risk that the fragile leading-out wires will be broken under the strain of handling.

Securing Valve Bases

A makeshift repair that will generally hold, provided that the valve is not disturbed too often, can be effected by flooding suitable adhesive (shellac varnish or even Seccotine, etc.) between bulb and base. But a more solid and lasting repair may be made by putting on a wire binding in the manner shown in the accompanying illustration, which is almost self-explanatory. The wire may be No. 22 or No. 24 tinned copper, and the various junction points should be soldered. It appears that there is little risk of cracking the bulb—especially of a metallised valve—provided that a really hot iron is used, and that the work is done quickly and with a light hand.



A loose valve base secured by a wire binding.

A NUMBER of receivers undoubtedly cover an appreciably narrower band of wavelengths than they should, for the sole reason that an excessively high amount of trimming capacity is used. This is particularly likely to be the case when the operation of setting the trimming condensers has been carried out in a more or less haphazard manner—which, after all, may be satisfactory enough from other points of view.

Minimum Trimming Capacity

If this defect is suspected it is a good plan to try the effect of retrimming, and to adopt the following procedure while carrying out the operation. Having tuned in a signal the ganged tuning condenser control knob should be rotated in a clockwise direction until the signal is only just audible; the capacity of all trimmers is then reduced until signals are again at maximum. Repeat this procedure of slightly increasing main condenser capacity and reducing trimming capacity, perhaps several times, until the setting of one or more of the trimmers approaches closely to its minimum capacity. Further reductions, introducing a risk that the circuit or circuits or lower stray capacity might be out of alignment with the others, would then be inadvisable.

AT first sight it would appear that the removal of the grid leak from a resistance-coupled L.F. amplifier should be responsible for a rise in anode current of the associated valve. By removing the leak, the normal supply of negative bias is interrupted, and so it might be expected that the valve would be operating with a "zero grid."

Sign of Good Insulation

In practice it will often be found that the removal of the leak brings about an actual decline of anode current. This is due to the accumulation of a charge on the grid condenser; the polarity is such that the grid, far from operating at zero potential, is biased negatively more heavily than usual. This state of affairs does not imply the existence of a fault, but indicates that the insulation throughout the circuit is of a high order.

HIGH-CAPACITY low-voltage electrolytic condensers, of between 25 and 50 mfds. capacity, and designed to work at pressures between 12 and 25 volts, are now so satisfactory and so readily obtainable that many readers have doubtless considered the possibility of using them to improve grid-circuit decoupling in existing receivers.

Grid-circuit Decoupling

There is little reason why this plan should not prove successful, but it is perhaps as well to point out that in a few cases its adoption will tend to provoke LF instability.

An improvement in grid-circuit decoupling is likely to lead to increased proportional amplification of low frequencies, and it is at these low frequencies that the decoupling system of any receiver is bound to be relatively ineffective. As a consequence, an originally stable receiver may show signs of "motor-boating."

The usual remedy, of course, is to increase the capacity of existing by-pass condensers; in but few cases will it be permissible to use decoupling resistances of higher value, and the alternative plan of using a choke for decoupling is unlikely to be entirely satisfactory, for the reason that a choke does not present a very high reactance to currents of low frequency.

The use of high-capacity low-voltage condensers is also to be considered for by-pass purposes in battery sets with automatic bias; one of the condensers may be connected across the bias resistor, and in the case of sets with an intermediate LF stage which is biased from the same source, between the intermediate resistor tap and the earth line.

INSTABILITY is unfortunately a trouble that is not confined exclusively to high-frequency amplifiers. For instance, a gramophone amplifier without any radio section may show a tendency towards uncontrollable self-oscillation, especially if the overall amplification is high.

LF Reaction

In certain circumstances the general performance of the amplifier may appear to be fairly satisfactory, but a weak high-pitched whistle may be evident. This is often due to stray couplings between the input and output ends of the amplifier. Accordingly, pick-up leads or microphone wiring should be kept well clear of the loud speaker and its connections.

IT can hardly be put forward as consolation to those who are unlucky with their valves that the anode cap of a burnt-out screen grid valve makes an excellent terminal holder. Nevertheless, the fact remains that these fittings are definitely useful; the bakelite shell which carries the anode terminal is easily removed, and a wire may then be soldered on to the shank. Two or three holes are then drilled through the shell for fixing screws.

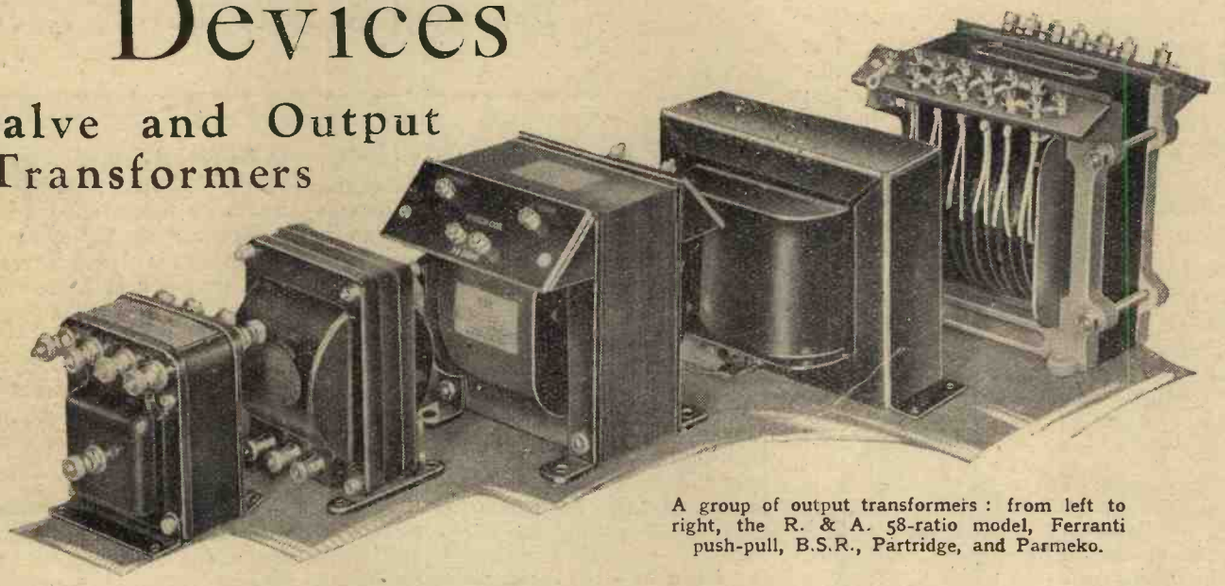
Improvised Terminals

If required, the terminal mount may be used as an insulating bushing on chassis of metal or thin wood by drilling a clearance hole of suitable size and inserting the terminal from the back or underside.

Anode cap of an SG valve mounted as an insulated terminal.

Low-Frequency Coupling Devices

Intervalve and Output Transformers



A group of output transformers : from left to right, the R. & A. 58-ratio model, Ferranti push-pull, B.S.R., Partridge, and Parmeko.

APART from the obvious fact that to justify its name an amplifier must, indeed, amplify, the most important point about apparatus for use at low frequencies is that it shall not introduce distortion. The commonest type of distortion caused by an intervalve coupling is unequal amplification of the different musical frequencies. Amplitude distortion, on the other hand, is usually to be attributed to a valve, but it can also be caused by an iron-cored coupling device.

The majority of intervalve couplings sold to-day are of the transformer type, for it seems customary where resistance or choke coupling is needed to obtain it from an assemblage of separate components rather than with a complete unit. Where transformer coupling is desired the choice of a suitable component is often a matter of difficulty, if only on account of the large number of different kinds now available. Intervalve transformers may be divided into two main classes—those which have a primary designed to pass an appreciable direct current, and those which have not. Each class may be further divided into two types—straight and push-pull transformers.

A transformer cannot be dissociated from the valve with which it is to be used, for the results obtained depend upon neither component alone but on the two in conjunction. The best transformer used with the wrong valve may well give a poorer performance than a cheap component used with the right valve. When a directly fed transformer is used, as in Fig. 1a, the amplification of the stage is nearly equal to the amplification factor of the valve multiplied by the turns ratio of the transformer for those frequencies for which the transformer primary reactance is high compared with the internal AC resistance of the valve. This is true for frequencies of 400 c/s to 2,000 c/s in most practical cases.

At low frequencies the amplification falls off owing to the reactance of the primary becoming comparable with the resistance of the valve, and it falls to 70 per cent. when the reactance becomes equal to the resistance. This is not an excessive loss for most purposes, and it leads to a simple rule for the choice of primary inductance. Divide the AC resistance (ohms) of the valve by the lowest frequency required, and multiply the result by 0.159; the answer gives the required primary inductance in henrys. Thus, if we have a 10,000-ohms valve and we take 50 cycles as the lowest frequency, the primary inductance should not be less than 31.8 H.

The Frequency Response

If the valve-maker's figure for valve resistance be used, it is wise to choose an inductance some 50 per cent. higher than the calculated figure, for under working conditions the valve resistance is usually very appreciably higher than the published figure, since it varies considerably with the grid and anode voltages applied to the valve. There is, of course, no objection to the use of a much higher value of primary inductance than that calculated, and in the reproduction of transients it is advantageous.

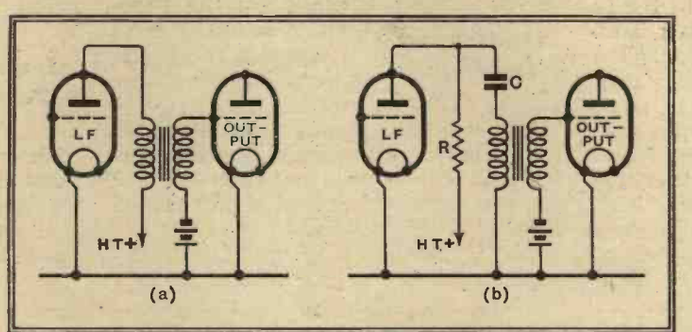


Fig. 1.—The direct coupling connections for an intervalve transformer are shown at (a) and the parallel-feed circuit at (b).

Having decided on the minimum primary inductance required, it remains to see whether this can be obtained. The inductance of any iron-cored coil varies somewhat with the direct current flowing through it and once the current exceeds a certain figure it usually falls rapidly. The transformer makers will usually quote a figure for the maximum permissible direct current through the winding and for the inductance at this current. It should be noted that it is unwise to exceed the current rating of the transformer, not so much for fear lest a winding should break down, but rather because amplitude distortion will occur if the flux density in the core be too great.

We now have to consider the high-frequency response of the transformer, and this usually depends largely on the resonance of the leakage inductance and self-capacity of the windings. A good response cannot be obtained unless both these factors are kept small, and this necessitates careful interleaving of the primary and secondary windings. In general, the larger the primary the more difficult it is to obtain a good response in the upper register if the turns ratio be maintained, and so the transformer must be more carefully sectionalised, and it will often have a larger core in order that the inductance may be increased without using a larger number of turns.

The makers of good quality components usually publish a curve showing the frequency response, and it must be remembered that this applies only when the transformer is used under the specified conditions. When the component is preceded by a valve of higher resistance the response is likely to be poorer at both low and high frequencies. It is not safe to conclude that a more even response will be obtained through the use of a valve of lower resistance, however, for although this may improve the bass it may lead to excessive amplification of the treble.

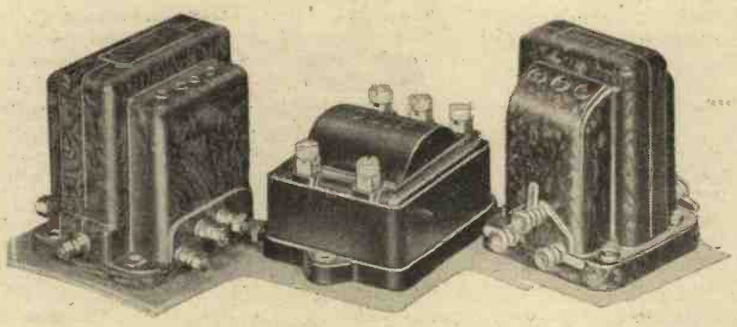
Low-Frequency Coupling Devices—

In the case of push-pull transformers the secondary is provided with a centre-tap, but otherwise the requirements are identical. It is highly important that the voltages developed across the two halves of the secondary should be equal and of opposite phase at all frequencies, otherwise correct operation cannot be secured. This is a matter upon which information is rarely obtainable, and one can only rely upon the reputation of the manufacturer. Sometimes the transformer secondary is split instead of a tapping being taken, and this is advantageous in a battery set since it enables different grid bias voltages to be applied to the two output valves. Transformers are also obtainable with both primary and secondary centre-tapped for use between two push-pull stages.

Class "B" and QPP

The ratio to be used in a transformer is not of major importance, and it will usually be settled automatically by the other requirements. Of two otherwise identical components it would normally be natural to choose the one with the higher ratio, but such a choice will rarely be available. In general, high ratio transformers have a poorer frequency characteristic than low ratio types, and the latter will usually be chosen where quality is the first consideration and the use of an extra valve is of little moment.

High ratio push-pull transformers, or QPP models, find their chief use in battery sets where the falling-off in the bass is of advantage rather than otherwise. Where the power output is limited, the lowest frequencies may not be reproduced at audible strength, and it is then best to reduce them before the output valve in order that it may not be loaded by potentials which serve no useful purpose. A high-ratio component is



Transformers for feeding quiescent output stages. On the left and right are the Sound Sales and Lissen Class "B" types and in the centre is a Graham-Farish QPP transformer.

desirable in a battery set, for it permits amplification to be obtained which does not have to be paid for in anode current.

A modified form of push-pull transformer is that known as the Class "B" type. This has a 1-1, or even a step-down, ratio, and is more like an output transformer than an intervalve component, since it functions with a load on its secondary. The chief requirements are correct ratio for matching the input resistance of the Class "B" valve to the preceding valve, a primary inductance of adequate value so that the primary reactance at the lowest important frequency is not less than the secondary load multiplied by the square of the turns ratio, and low-resistance windings, particularly for the secondary. In addition, the leakage inductance must be low in order to obtain a good high-frequency response.

Transformers of this type are far more like output transformers than ordinary intervalve couplings, and the efficiency is quite an important characteristic. It may be said that satisfactory Class "B" working demands a very well-designed driver transformer.

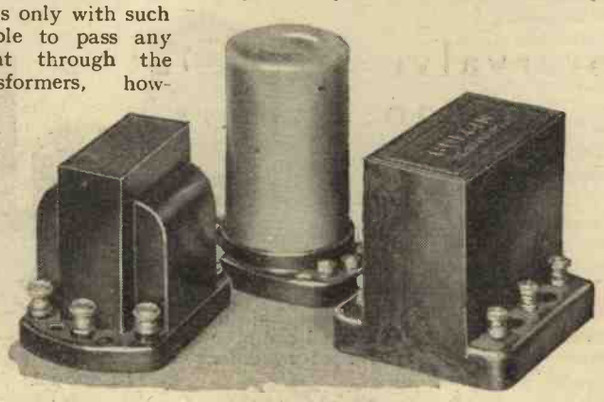
High Permeability Coils

So far, only transformers with cores of Stalloy or silicon steel have been considered, for, in general, it is only with such cores that it is permissible to pass any appreciable direct current through the windings. Many transformers, however, have a core of some high permeability alloy. Although such materials are considerably more expensive than transformer iron, a smaller quantity is needed, and the number of turns on the windings can often be reduced, and this tends to reduce the leakage inductance and so gives a better frequency response. Much depends upon which factor the designer considers the most important, but if a representative of each type be taken having the same frequency response, the one with the high permeability core will usually be smaller, lighter, and cheaper.

These cores have one disadvantage, however, for it is rarely safe to pass more than about one milliampere of direct current through the primary, so that in practice it is usually essential to employ a resistance-capacity filter circuit. This is shown in Fig. 1b, and, by suitably choosing the value of the coupling condenser C, the bass response may often be maintained at lower frequencies than one would expect from the primary inductance of the transformer. The presence of the coupling resistance R also affects the frequency response at both high and low frequencies, and it leads to the same effect as the use in the directly fed circuit of a valve having an AC resistance equal to its actual resistance in parallel with R. This resistance R also affects the stage gain, which becomes equal to that given by a resistance-coupled amplifier, having a coupling resistance equal to R, multiplied by the turns ratio of the transformer. The parallel-feed circuit, therefore, gives somewhat lower amplification than is obtainable with direct feed.

This arrangement, of course, is not confined to high permeability cored transformers, and it is often used with other types, although it then rarely has any great advantage. It is so necessary, however, with the special core materials that some makers supply their transformers as coupling units complete with coupling resistance and condenser, and sometimes also with a decoupling resistance.

Turning now to output transformers, we find the conditions somewhat different, for the component must now handle an appreciable power, and the primary must often carry a heavy direct current. The second-



The Multitone Tone Control transformer is shown on the left, with the Benjamin Transfeeda in the centre and the Bulgin Transcoupler on the right.

ary turns, too, are usually less than the primary. The first requisite is that the ratio should be correct, and this depends upon the load impedance required by the output stage and the speech coil impedance of the loud speaker, and it may be calculated by dividing the load impedance by the speech coil impedance and taking the square root of the result.

Ideally, the primary inductance when carrying the normal anode current of the output stage, perhaps 60 mA., should be such that the primary reactance is not less than twice the load resistance required by the valve at the lowest frequency reproduced. A high primary inductance means a large number of turns and a large core, which usually requires an air-gap. In the case of an amplifier delivering an output of more than about 4 watts, the primary inductance may have to be even higher than has just been indicated in order to avoid an excessive flux density in the core which would lead to amplitude distortion.

A high primary inductance not only makes the transformer bulky and expensive, but is apt to have a deleterious effect upon the high-frequency response. The self-capacity of the windings has no adverse effect upon the performance, but the unavoidable leakage inductance has the effect of reducing the efficiency of transfer between the windings at high frequencies. Now for a given construction the leakage inductance increases with the primary turns, so that, unless a high primary inductance is secured by increasing the size of the core, the upper register is affected. Much can be done, however, by building the windings in the form of many interleaved sections.

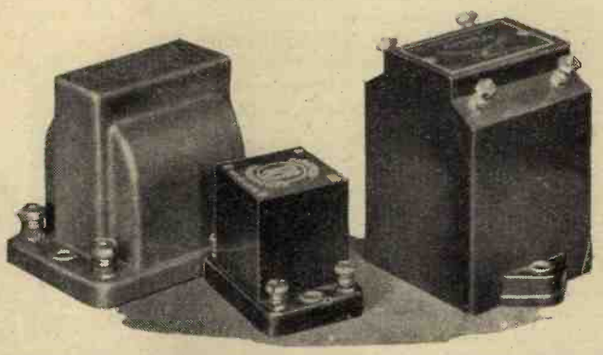
Push-pull Output Transformers

A push-pull output transformer must have an accurately centre-tapped primary, and the windings must be exactly balanced, so that the correct phase relationships are maintained at all frequencies. In the case of a transformer used for an ordinary, or Class "A," output stage, the effect of the direct current through the windings is balanced out, and it is much easier to obtain

Low-Frequency Coupling Devices—

the desired characteristics—particularly the combination of a high primary inductance with low leakage inductance. Incidentally this is not the least of the advantages of the push-pull circuit.

When we consider Class "B" and QPP output transformers we find that, although we are using a form of push-pull, we have lost this particular advantage. Although the quiescent current is low it may reach 40 mA. on loud passages of music, and, as the current flows only through half of the primary at a time, the core is affected by it. The transformer, therefore, must be designed for operating with quite a large direct current through the primary. In addition, the DC resistance of the winding must be low.



A Ferranti and a Varley intervalve transformer are shown to the left and right respectively with an R.I. Parafeed transformer in the foreground.

Where the best possible performance is required with any type of output transformer, and particularly where the output is large, the requirements are so strict that it is impracticable to provide more than a single ratio. If the direct current through the windings is only moderate, however, and some compromise between the various conflicting factors is allowable, it is possible to arrange for tappings on the windings, so that a single transformer can provide many different ratios. Such transformers are now quite common, and are often termed Universal types.

Strictly speaking, a transformer designed for matching a particular speaker to different valves should have a tapped primary and one for matching different speakers to the same valve, a tapped secondary. A truly universal transformer for matching any speaker to any valve should have both primary and secondary tapped. It is often not possible to follow this rule owing to the complication involved when many ratios must be provided, and this is particularly so in the case of push-pull types; but, although they may not be theoretically perfect, very good results are often secured.

A modified form of push-pull output transformer has made its appearance in recent months, and is known as the duo-phase type. As regards its main windings it is identical with any ordinary push-pull transformer, but it is provided with a third winding which is used for feeding one of the output valves, the other being fed in any desired manner, and not necessarily by a push-pull intervalve transformer.

The chief types of transformers, both intervalve and output, have been briefly dealt with in this article, and it only remains to consider a few special types. Intervalve transformers are sometimes modified in order to provide tone-correction, the desired characteristic in this case being one which rises greatly at high frequencies, and this result can be obtained at the expense of amplification by shunting the primary of a more or less conventional transformer by a small choke and resistance. In other cases a variable tone-correction characteristic is produced by a special disposition of the windings, and the precise characteristic can be varied over wide limits by means of a potentiometer, thus making a very effective tone control.

NEW BOOKS

Radio Physics Course (2nd edition, revised and enlarged). By Alfred A. Gherardi; pp. XIV+972; 509 illustrations; $3.85. Radio and Technical Publishing Co., 45, Astor Place, New York City.

To find a radio text-book which is at the same time complete, thorough, up to date and lucid has always presented some difficulty. Yet these are the outstanding features of "Radio Physics Course" (2nd Edition) by A. A. Gherardi. It is an elementary text-book of remarkable merit and a work of the first importance to those making a serious study of the subject from the beginning, whether privately or at a technical college.

The author explains in the preface that the title is chosen because Physics means the explanation of common things, Radio Physics thus implying the explanation of the common things in radio, and his explanations are most lucid.

The thoroughness of the work may be gauged from the fact that about 300 out of the 972 pages are devoted to a course in electricity, written in a manner making for easy application to radio circuits and devices.

All branches of the subject are very well covered, and chapters are also devoted to special applications of valves, sound films and television. The chapters on valves—theory, characteristics, constructional features and applications—are excellent. Instructions are given for many practical experiments and measurements, worked numerical examples are included, and selected review questions are appended at the end of each chapter. Useful appendices and tables are given at the end of the book.

From the point of view of the amateur the book may well be classed as an indispensable work of reference. O. P.

Modern Clocks, Their Design and Maintenance. By T. R. Robinson. Published by N.A.G. Press, Ltd., 26-28, Old Street, London, E.C.1. Price 4s.

Electric clocks are now so generally regarded as an extra fitment to wireless receivers that those who take an interest in the operation of their sets must, quite naturally, turn an enquiring mind to the mechanism of the electric clock and wish to know the principle on which it operates.

This little book gives a very excellent general explanation of the various systems in use and explains their principle. No proper understanding of electric examples is complete unless the general mechanism of clocks is also understood and, realising this, the author provides with this book an excellent introduction to the whole subject of the modern timepiece.

SCIENTIFIC P.A. MICROPHONE

An Inexpensive High-Grade Instrument

A TRANSVERSE-CURRENT microphone that can be described genuinely as a high-grade instrument has been developed by the Scientific Supply Stores (Wireless), Ltd., 126, Newington Causeway, London, S.E.1, and is sold at the very reasonable price of 55s. It has a particularly good frequency characteristic which by aural tests appears to be sensibly flat from about 200 c/s to 3,500 c/s; below and above these limits the output is definitely smaller, though it does not cut off until the higher region of the audible range is reached, and there is a useful output even as low as 50 c/s.

Scientific PA microphone mounted in a table-type stand.

As with all microphones of this pattern the resistance is comparatively high—about 500 ohms in the present case—and consequently the output is small, being on the average a shade less than 0.1 volt across the secondary of the transformer designed for this microphone.

A small output is not necessarily a disadvantage, since it is comparatively easy to obtain a gain of 500 or more from a small amplifier, though for public address work a three-stage, resistance-coupled amplifier giving a higher gain is advisable, and is quite practicable, since the noise level of the microphone is low, and an amplification of the order of 1,000 is permissible.

It operates satisfactorily with a six-volt battery, but best results are obtained with from 8 to 10 volts, the average current through the microphone then being about 25 mA.

Housed in a black-moulded bakelite case, measuring 5¼in. × 4¼in. × 2¼in. deep, it has the appearance of quite an expensive instrument, especially when mounted in the chromium-plated ring-type stand designed especially for it.

Silk-covered rubber suspension cords are fitted, and a desk-type telescopic stand, chromium-plated and with an 18in. extension, costs 22s. 6d; while a floor model with a 70in. extension is available at 40s.; the microphone in a floor stand thus costing £4 15s. complete. The microphone transformer designed for this instrument costs 12s. 6d.

ADVANCE IN CAR RADIO

A Test Run with an Experimental Set Proves its Utility.

By J. Granville Stephens.

Reprinted by the Courtesy of the "Nottingham Journal," December 8th, 1934.

UNTIL this week, I must confess, I was one of the sceptics in regard to car radio. As a motorist, I felt that it would be a distraction from the driver's point of view; as an owner-driver, I felt that I did not require this entertainment whilst on the road.

But as a result of enjoying what one might call a "pre-view" (or should one say "pre-hear"?) of a forthcoming British car radio receiver which has a revolutionary principle incorporated, I am going to take a woman's privilege, and change my mind.

For this change of outlook and heart I have to thank my friend, Mr. Gordon Ward, of the City Accumulator Company, of London, who, in conjunction with Messrs. Butcher Brothers, of Nottingham, is staging a trade exhibition on South Parade.

This, by the way, closes to-night, and I advise any of my readers who can snatch away this evening to take advantage of the unique opportunity of consulting Major W. I. G. Page (late of the technical staff of *The Wireless World*) regarding the wonders of the Austin radio receivers on view.

Those who do so will probably appreciate the significance of the statement that the car radio I heard is an Austin set. It is not yet on the market, but will be available in January.

Better Conditions.

Major Page has made a special study of car radio, and the receiver which will shortly claim attention is a foremost example of a British product with reception of both medium and long wavebands, and is a notable example of his high achievements in radio design.

This is real radio news. I am the first radio correspondent to have the privilege of a test run in a car fitted with this equipment. It was the experimental model that I heard working.

But, first of all, let me start my story at the beginning. Hitherto, there have been difficulties in the way of car radio because of the limited supply of valves and other suitable components. These have now been cleared away.

Tremendous improvements in valve technique have been made, and sets with British 13-volt valves (the type to work from the car battery) are claimed to be from two to three times as sensitive as those incorporaing foreign valves.

But it is in the matter of high-tension supply that the Austin set brings the greater triumph to British car radio. It incorporates the principle of the rotary generator instead of the vibrator.

The latter needs much more smoothing, because you get a sudden transient of current which swings from maximum to zero, and is, therefore, most difficult to smooth adequately. The worst that can be said of the converter is that a high-commutator ripple is superimposed on the signal.

This is easily dealt with by the liberal smoothing provided.

Vital A.V.C.

The receiver is a super-heterodyne, with a signal-frequency stage of amplification.

The full automatic volume control provided is a vital factor, as may be gauged by the following anecdote first told to me by Major Page, and probably published here for the first time.

In the course of his earlier experiments, he was driving along Kensington High Street, London, when he found that the input from London Regional varied from 100 to 1 in the course of the run along this thoroughfare.

This, of course, was due to the screening effects of various buildings, but to maintain a standard level of strength must have proved a severe test for any A.V.C. system.

The output of the set is three watts, using a pentode valve, which drives a 6in. moving-coil speaker of the energised type (this is a 27-ohm type, with its field connected across the car battery).

The high-tension current of 250 volts is supplied by a small rotary converter incorporated in the set, and the interference from either this or the car engine is negligible.

On the open road it was wonderful to listen to Fécamp, Budapest, Brussels No. 1, Athlone, and other stations not too easy to tune in, while stations like Radio Toulouse, Poste Parisien, Hamburg, and the British stations rolled in at remarkable strength. Indeed, it was quite equal, if not superior, to having a set in one's home, with an outdoor aerial, bringing in the stations like clockwork.

Entertainment Value.

The entertainment value of a car radio must largely be judged by what is available on Sundays, when the car is used more for pleasure than any other day of the week.

This is where the provision of the long-wave reception is most important. We know that the entertainment value of British programmes on a Sunday is at its lowest. Therefore, a set that is to be a source of real entertainment to the motorist on a Sunday must be able to give adequate service on, say, Huizen, Radio Paris, Luxemburg, and Kalundborg, as well as Droitwich.

This instrument did this and more. And so I was convinced of its utility and appeal.

Car radio, on a long run, as from London to Nottingham, or from Nottingham to Scotland, gives an entirely new aspect of driving. It will while away the time on long journeys, keep the driver awake when he is inclined to get drowsy, and still, so far as I have been able to judge, not distract him from his control.

The radio control is placed handy on the right of the car, and if limitations of space call for the set to be stowed away, a remote control can be fixed to the steering column.

This has been a most interesting experience which I would not have missed for anything.

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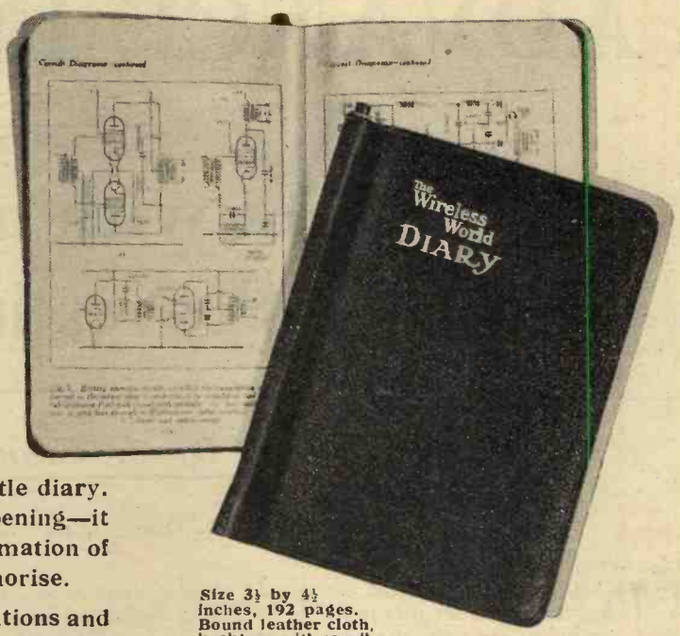
A Combined Diary and Reference Book for Every Keen Amateur

The Wireless World DIARY for 1935



Size 3½ by 4½ inches, 192 pages. Bound leather cloth, back loop with pencil.

Every wireless enthusiast should have this handy little diary. In addition to the usual pages—one week at an opening—it contains 79 pages of facts, formulæ and general information of the kind that is always wanted but is difficult to memorise.

There is a complete list of European Broadcasting Stations and Short-Wave Stations of the World. In addition an important section contains all the essential technical data relating to valves on the British market, including the latest type of frequency changers, pentodes and multi-electrode valves.

Fourteen pages of circuit diagrams of receivers, amplifiers and rectifiers are also included, as well as useful information on the prevention of mains interference, and data for winding coils.

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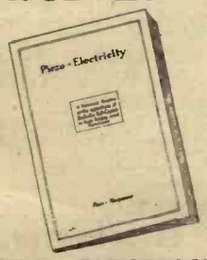

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Every reader of "The Wireless World" should obtain this new technical treatise, which deals exhaustively with the application of Rochelle salt Crystals to high fidelity reproducers. This is the first book published in this country devoted to Piezo-Electricity and in addition to circuit data fully describes the fidelity devices which are now available. The issue is limited. Send for your copy to-day. PRICE 3d. post free.

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CURRENT TOPICS

Events of the Week in Brief

The New Selectivity

MANY citizens in the Salzburg region are reported to have been troubled by the political broadcasts from Munich. A firm now markets a receiver "guaranteed not to hear Munich."

R.N.W.A.R. Progress

MEMBERS of the Royal Naval Wireless Auxiliary Reserve who have attained the grade of First Class Operator are now permitted to work on the new frequencies of 5,015 and 2,507.5 k/c., in addition to the standard frequency channel of 3,740 to 4,000 k/c.

Another Tenth Anniversary

THE tenth anniversary of Swedish broadcasting is about to be celebrated. In a special booklet published by the broadcasting service, "Radio Tjanst," nearly two hundred prominent Swedish personalities discuss wireless as an art form and educational factor.

Expensive Listeners

A PECULIAR viewpoint is expressed by *Az Ujsag*, a leading Hungarian paper, commenting on the latest radio licence figures—namely, 320,000. The journal contends that, taking into account the cost of the transmitting station, of the new studios and management, every new subscriber to the service has cost the State 1,200 pengo —*i.e.*, about £72.

"High Fidelity"

BROADCASTING is said to have reached its peak with the opening of station KYW on Monday, December 3rd, in Philadelphia. According to Westinghouse engineers the station combines the most advanced practice in radio engineering with a unique directional antenna system. There are four vertical masts, 245 feet high.

KYW was the second station to begin operating in America, having been licensed in 1921.

English from Madrid

A SPECIAL short-wave Christmas programme is to be broadcast by EAQ, Madrid, on 30.43 metres by arrangement with the International Short-wave Club. The transmission, which will be conducted in English by officers of the London Chapter, takes place on Saturday, December 22nd, from 00.00 to 00.30 (G.M.T.), i.e., from Friday midnight. Reports will be welcomed by Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16, and a special verification will be sent to all enclosing return postage.

Radio House, 1937

IN the great exhibition of 1937 France will include a *Maison de la Radio*, in which the latest developments in domestic wireless will be faithfully portrayed.

Public as Informers

HIGH praise has been showered on the new French P.M.G., M. Georges Mandel, for cancelling a clause in the new wireless law making it compulsory for house-owners to acquaint the authorities with the names of all tenants possessing wireless receivers.

According to our Paris correspondent, credit is due in part to house-owners themselves, who have resolutely refused to become public informers.

Listening in Norway

THE Norwegian Broadcasting Corporation announces that there are now 150,236 licensed listeners in the country. Oslo contains 41,000 registered listeners.

Sold Seventeen Times

A FRENCH contemporary warns its readers against a plausible radio salesman who is offering a set which is known to have been sold seventeen times. The vendor's method is to sell this excellent receiver and then to call next day in order to set right a defect which, he declares, has been found to be common in all sets of that particular series. Unfortunately for the purchaser neither set nor salesman are seen again.

"THE RECEIVER IN OUTWARD FORM." This Marseilles amateur just missed *The Wireless World* series with this Christmas effort at housing set, gramophone, record case, speaker and programme journal in a single cabinet. Winding the gramophone without extracting it from the cabinet must be child's play—if the child's hands are small enough.

Short Waves from Sottens

TO-MORROW, December 15th, a special short-wave programme under the auspices of the International DX'ers Alliance is to be broadcast from the League of Nations stations, HBL (31.27 metres) and HBP (38.47 metres) at 22.30 (G.M.T.). Reports will be welcomed by the I.D.A., 56, East Grove Road, St. Leonards, Exeter, Devon.

International DX'ers Alliance

THE International DX'ers Alliance has now formed an official Chapter in England. All interested in DX reception on medium or short waves are invited to communicate with the Hon. Secretary, Mr. J. Knight, 6, Fleetwood Street, London, N.16. A second English Chapter is to be formed in Manchester shortly.

"W.W." at Christmas

NEXT week's issue of *The Wireless World*, dated December 21st, will be on sale on Thursday, December 20th.

Miscellaneous Advertisements

THE approach of the Christmas holidays necessitates slight alterations in our printing arrangements. Small advertisements intended for the issue of December 28th should reach the publishing office not later than first post on Thursday next, December 20th.

Danish Broadcasting House

A CONCERT hall with 1,600 seats and a concrete and steel tower 500 feet high are provided for in the plans for Denmark's new Broadcasting House in Copenhagen. According to the report of a special committee just published, the building will cost about seven million kroner.

Trying

A TENANT charged at Viborg, Jutland, for refusing to pay his rent, complained that his apartment was no longer habitable because his landlord allowed his six-valve superhet to operate from 7 a.m. to 1 a.m. daily. The amenities were further upset because two musicians, one with a violin and one with a trumpet, joined the radio concert in order "to learn first-hand from English dance bands how to play jazz music in the right style"!

A Belgian Record ?

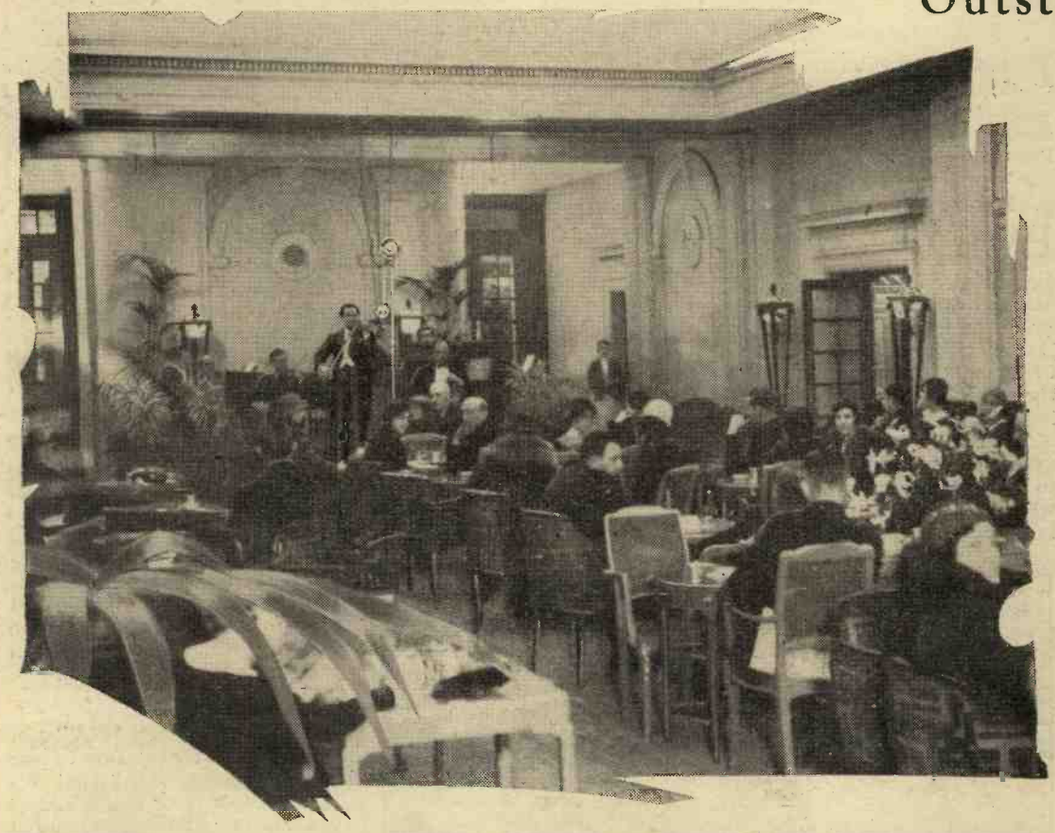
FEW countries can show such a tremendous growth in the number of licensed listeners as Belgium. In 1930 there were only 44,000 listeners in the country; in 1931, 76,872; while by 1932 the figure had nearly tripled itself by totalling 200,543. In 1933 Belgium had 463,016 listeners; while up to August of this year the number had increased to 550,165.

Sportsmen, Please Note!

A FRENCH contemporary offers in its Hints and Tips page some advice to shooters of wild duck. It suggests that a microphone attached to a short-wave transmitter should be installed in a poultry yard, and that the cries of the domestic birds should be picked up on a short-wave receiver in the marshes and rediffused by loud speaker. This arrangement should bring "good supplies of quarry within range."

★ ★ Listeners' Guide for

Outstanding Broadcasts



ALBERT SANDLER and the Park Lane Hotel Orchestra will be heard on Sunday evening at 9 o'clock in the National programme. This photograph was taken in the lounge during an actual broadcast.

TEMPTATION.

To link up the coming week's programmes with that "darkest hour before the dawn"—the dawn being Christmas—is an obvious temptation which I shall resist. Let us merely say that the fare has often been, and often will be, better, which is only natural because big peak events like Christmas inevitably produce troughs before and after.

And now, having drained the cocktails, let us glance down the menu.

◈ ◈ ◈

NATIVITY PLAY.

THE Christmas flavour is first noticeable on Tuesday next, December 18th, when the Nativity Play "Bethlehem" is relayed Nationally at 8.30 p.m., from St. Hilary, Cornwall. This simple drama by the parishioners will be produced by Filson Young and Bernard Walke. This is the ninth year in which the play has been performed.

◈ ◈ ◈

STRASBOURG OR ST. HILARY?

YET another of those grand gala concerts from Strasbourg. Strasbourg really does get the gala spirit over the microphone, and I shall certainly be torn between two allegiances at 8.30 on Tuesday. Shall I listen to the St. Hilary Nativity Play, from the B.B.C. transmitters, or to those "special choirs from professional schools" which will combine voices with the Orpheus Club of Valancienne in this festive concert from Strasbourg PTT at the same time?

◈ ◈ ◈

SIR AUSTEN CHAMBERLAIN.

TO-NIGHT'S "Causes of War" talk is by Sir Austen Chamberlain, and may well be the most interesting of the lot. Sir Austen, as a former Foreign Minister, is steeped in experience of diplomatic exchanges, and is, of course, famous for the part he took in the fashioning of the Locarno Treaty. Not to tune in on the National wavelength at 10 to-night will be to miss a really authoritative talk.

THE MIKE ON HIKE.

WAYWARD friends of mine who hate ceremony and always pray for a hitch in official arrangements are unanimous in praise of the "Microphone at Large" broadcasts from Midland Regional. London shares one of these to-night (Friday), at 9.15, when the microphone will be taken to Ross-on-Wye to be installed in the house of a former local worthy John Kyrle.

Owen Reed, who organises these mike hikes, is unrivalled in securing the air of downright spontaneity. We have not yet forgotten that glorious lapse during the Chipping Campden affair.

◈ ◈ ◈

POTTED WAGNER.

TOULOUSE is giving some excellent concert versions of well-known operas. Next Monday's opera is Wagner's "Siegfried" to be broadcast at 10.30 p.m. These concert versions are condensed and peptonised, but are none the less attractive on that account.

TWICE IN ONE DAY.

FOR the first time since the world began the B.B.C. is broadcasting an entertainment twice on the same day on the same wavelength. "The Princess of Paraphernalia" — a musical extravaganza—is to be broadcast to London and Midland Regional listeners at 4 p.m. on Thursday next, December 20th, and again at 7.30 p.m.

Described as a feast of nonsense for all children under 100, it is the work of Gordon Crier, "with lovely music" by John Morley. Martin Webster is producer, and H. Foster Clark conducts the B.B.C. Midland Orchestra and Wireless Singers.

◈ ◈ ◈

CHRISTOPHER BEAN.

ADMIRERS of "The Late Christopher Bean" will tune in Poste Parisien at 8.30 p.m. on Thursday next, December 20th, when the play will be broadcast upon which this delightful comedy was founded, "Prenez garde à la Peinture" by Fauchois.

SIR AUSTEN CHAMBERLAIN, whose talk in the "Causes of War" series will be heard this evening (Friday) at 10 o'clock.

the Week

at Home and Abroad

THE " B MINOR."

FIVE hundred and eighty-five boys will be taking part in the broadcast of part of Bach's B Minor Mass on Sunday (Regionals, 5.45), from the Great Hall of Oundle School. Two hundred and thirty boys will constitute the choir, thirty-five the orchestra, and three hundred and twenty the chorus. To augment the boys' orchestra Mr. Charles Woodhouse, leader of the B.B.C. orchestra at the Promenade Concerts, will introduce a number of well-known players. Four guest singers, Elsie Suddaby, Astra Desmond, Arthur Cranmer, and Steuart Wilson, will also take part. The conductor is Mr. Clement M. Spurling, who was appointed Director of Music to Oundle forty-four years ago.

The B Minor Mass is generally accepted as one of the greatest things in all music.

NEW TO BROADCASTING. George Garay and his Hungarian Gypsy Band, who make their broadcast debut at 3.30 on December 17th (London Regional) in a programme from the Hungarian Restaurant.

WHEN HE WAS VERY YOUNG.

REGINALD KING, who brings his orchestra to the Regional studio at 7.30 to-morrow evening, must have been inoculated with the music germ at birth. Mr. King, senior, told me the other day that "Reggie" was so musical at the age of five that when it was proposed to buy a new motor car he said, "No, daddy, please get a new piano."

ENGLISH FLAVOUR IN DENMARK.

I SOMETIMES think that the Danish programmes have a more English flavour than any others on the Continent. At noon on Sunday Copenhagen and Kalundborg will give us Mr. P. Boisen reading excerpts from Dickens' "Christmas Carol" in English, while on Tuesday morning, December 18th, at 10.15, Mr. C. Campbell-MacCallum and Mr. C. Nielsen come before the microphone in everyday dialogues in English.

To go back to Sunday: At 7.30 Copenhagen's wireless orchestra is to play some famous waltzes by the "Scandinavian Strauss"—H. C. Lumbye—and the concert will be relayed by the Deutschlandsender. At night Teddy Petersen's famous dance band will be heard at the Wivex Restaurant.

COMPARISONS ARE MELODIOUS.

WHETHER or not we are lovers of military band music there is something attractive in the idea of comparing the military bands of North America, Venezuela, Brazil, Argentine and Japan. This is the theme of a special concert from the Deutschlandsender, Leipzig and Breslau, at 7.15 p.m. on Monday next. The concert lasts until 9 o'clock.

CORTOT IS THERE.

LIKE the man whose passion for green peas led him to travel annually from Cairo northwards to Inverness in order to enjoy that delectable dainty at its seasonable best, I like to travel across Europe, radiophonically speaking, in pursuit of the nimble M. Cortot. The great French pianist has lately been heard in Holland as well as his beloved France; now he is in Switzerland and to-morrow night appears in the Symphony concert of the Basle Music Society, to be broadcast by Beromunster between 7 and 9 p.m. Weingartner will conduct.

THE HUNT GOES ON.

IT is also possible to follow the same piece of music from country to country. As *World Radio* recently remarked: "Last week we had an abundance of 'La Bohême' performances. This week . . . . Beethoven's Fifth Symphony is to be broadcast on Sunday afternoon from Radio-Paris and on Monday evening from Budapest, and two performances of Tchaikovsky's Fifth Symphony are to be heard on Tuesday evening from Frankfurt and Hilversum."

BALANCE AND CONTROL.

HOW much there is in the titling of a broadcast item! Although I cannot quite see how the thrills will be communicated to the listener, I shall make a serious effort to tune in Brussels No. 1 at 8.35 p.m. on Wednesday next, December 19th, to hear Mr. Fleischman's radio play (music by Poot) entitled "Archibald, the Tight-rope Dancer."

THE AUDITOR.

TEDDY PETERSEN, leader of the famous Wivex Hotel hot dance band, broadcasting from Copenhagen at 11 p.m. on Sunday next.

HIGHLIGHTS OF THE WEEK

FRIDAY, DEC. 14th.

Nat., 7.30, "The Great Adventure," comedy by Arnold Bennett. 10, "Causes of War," talk by Sir Austen Chamberlain.

London Reg., 7.15, Henry Hall and the B.B.C. Dance Orchestra. 8, B.B.C. Orchestral Concert; Music by Joseph Holbrooke.

Abroad.

Sottens, 7.30, Wagner Concert.

Monte Ceneri, 7, Opera: "Lucia di Lammermoor" (Donizetti).

SATURDAY, DEC. 15th.

Nat., 7, "In Town To-night." 8.30, "Music Hall," with Harry Roy and His Band.

London Reg., 7.30, Reginald King and His Orchestra. 8.45, The Reginald Paul Quartet.

Abroad.

Stuttgart, 7.15, Concert by Karlsruhe State Theatre Choir and Orchestra.

SUNDAY, DEC. 16th.

Nat., 1.30, Belfast Wireless Orchestra. 5.15, "Hints for Daily Living," by the Rev. Canon H. R. L. Sheppard, C.H., D.D. 5.30, "Hamlet," by William Shakespeare, with Stephen Haggard (Hamlet) and Fay Compton (Ophelia). 8.45, Appeal for Merthyr General Hospital by Sir J. Gomer Berry, Bart. 9, Albert Sandler and the Park Lane Hotel Orchestra.

London Reg., 5.45, Bach's Mass in B Minor from Oundle School. 9.30, Sunday Orchestral Concert.

Abroad.

Brussels, 8.40, Saint-Saëns Concert.

Vienna, 6.50, Beethoven's Seventh Symphony.

MONDAY, DEC. 17th.

Nat., 8, Musical Comedy: "The Girl Friend," with Dorothy Dickson, Jack Melford, Elsie Carlisle and Fred Duprez. 10, Kutcher String Quartet.

London Reg., 8.15, Recital of French organ music by G. D. Cunningham in B.B.C. Concert Hall.

Abroad.

Brussels, 8, Marsick Festival Concert.

TUESDAY, DEC. 18th.

Nat., 8.30, St. Hilary Nativity Play, "Bethlehem." 10, "Star Gazing" by Dr. R. W. Waterfield.

London and Mid. Regional, 8, B.B.C. Midland Orchestra. 9, "The Girl Friend."

Abroad.

Radio-Paris, 8.45, Variety: "La gazette de Montmartre."

WEDNESDAY, DEC. 19th.

Nat., 8.10, "The Golden Legend" (Sullivan) with B.B.C. Orchestra (Section B) conducted by Adrian Boult. 10, National Lecture by Dr. T. R. Glover.

London Reg., 8, Chopin Recital by Boleslas Woytowicz, relayed from Warsaw. 8.30, Variety: Bransby Williams in "Poor Old Sam."

Abroad.

Luxembourg, 9.10, Popular Music of Many Lands.

THURSDAY, DEC. 20th.

Nat., 8, Callender's Band. 8.45, "Soft Lights and Sweet Music—Memories of 1934."

London and Mid. Reg., 4 and 7.30, "Princess of Paraphernalia."

Abroad.

Rome, 8.30, Symphony Concert.

Copenhagen, 8.10, Potpourri of "Die Fledermaus" (Strauss).

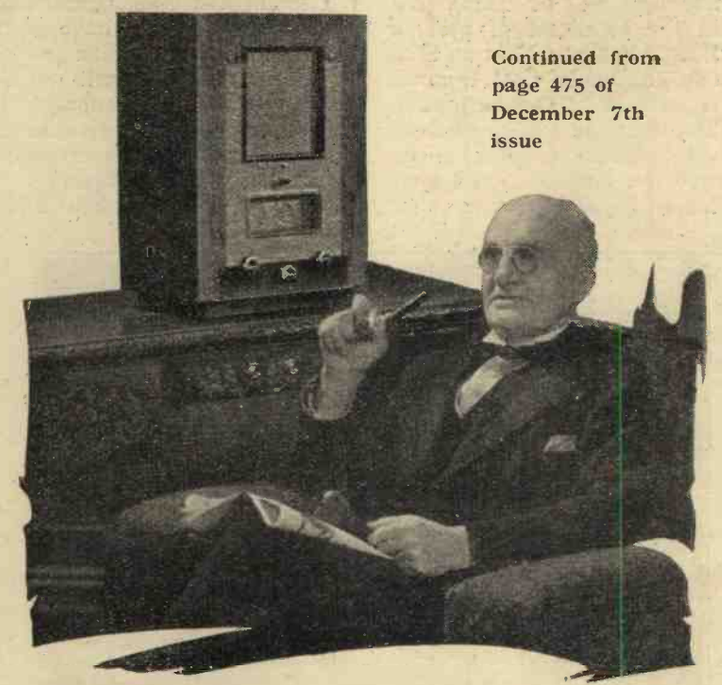
The Wireless World

Guide to Receivers II.

Salient Features of the Principal Sets

IN last week's issue we dealt with radio-gramophones and the majority of the more expensive receivers. The remainder of the latter category is described in this instalment, which also contains information regarding medium-priced sets. Popular receivers costing 10 *gns. or less will be similarly treated in our issue of December* 21*st. Unless otherwise stated, sets are "table models," designed primarily to work with an outside aerial. Power rectifiers are not included in the number of valves.*

Continued from page 475 of December 7th issue



RECEIVERS: 15 GNS. AND ABOVE

(Continued)

Long Battery Life

PHILCO MODEL 238 17 gns.
Four-valve Superhet Receiver for Operation from batteries

Designed to give a performance comparable with that of a mains-operated receiver, this set is supplied with a triple-capacity HT battery designed to give 9 to 10 months' service at 2 hours per day. The power output from the Class "B" amplifier is 1½ watts, and the average HT consumption is 10 mA. The tuning dial is illuminated, and battery replacement is simplified by one-plug HT and GB connections.

A Striking Cabinet Design

PHILCO MODEL 264 CONCERT GRAND 17 gns.
Four-valve Superhet. Receiver for AC Mains Only

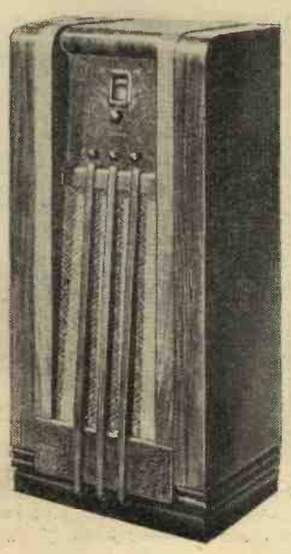
In this instrument the standard Model 263 Universal receiver is also available in this cabinet and is known as the Model 1263. The price is 19 guineas.

A Well-designed Universal Receiver

PHILCO MODEL 263 15 gns.
Four-valve Superhet for AC or DC Mains

Essentially the circuit is the same as that of the Model 264 AC mains receiver, but the valves are of the universal type, and a ballast resistance is incorporated to compensate for fluctuations in mains voltage. The instrument is available in a de luxe cabinet finished in black walnut and Australian curly oak, at 16 guineas. The latter model incorporates shadow tuning and a 4-point tone control.

Philco Radio & Television Corporation of Great Britain, Ltd., Aintree Road, Perivale, Middlesex.



Philco Model 238 battery receiver and (right) Concert Grand version of Model 264 for AC mains.

Philco superheterodyne chassis is housed in a vertical cabinet of original design. The controls are placed on a high level, and the 11-inch "Auditorium" loud speaker is mounted on an inclined sounding board of large area. The

Modern "Straight" Circuit Design

PHILIPS TYPE 427A. 15 gns.
Five-valve AC Mains Receiver for External or Mains Aerial

This is neither the time nor place for reviving the controversy regarding the respective merits of straight and superheterodyne circuits, but it is safe to say that as long as straight sets such as those produced by Philips and one or two other firms are available, the superhet will not have things all its own way.

The present receiver embodies two HF stages with four tuned circuits of high efficiency, a diode detector, and a two-stage LF amplifier. Automatic volume control is provided, and there is a device to ensure constant sensitivity at all wavelengths.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

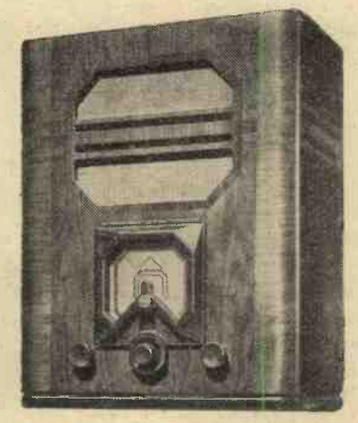
"Wireless" without Wires

PYE SP/AC 16 gns.
Four-valve Superheterodyne for AC Mains, operating on built-in Frame Aerial

The frame-aerial mains set has lately assumed considerable importance, and the present model, which is entirely self-contained except for a connection to the electrical supply socket, is particularly attractive when no facilities exist for erecting an aerial—or even to those who regard an aerial as an anachronism.

Like all other sets of its general type, the SP/AC includes a signal-frequency HF stage, which is fol-

Philco Model 1263 for AC/DC mains

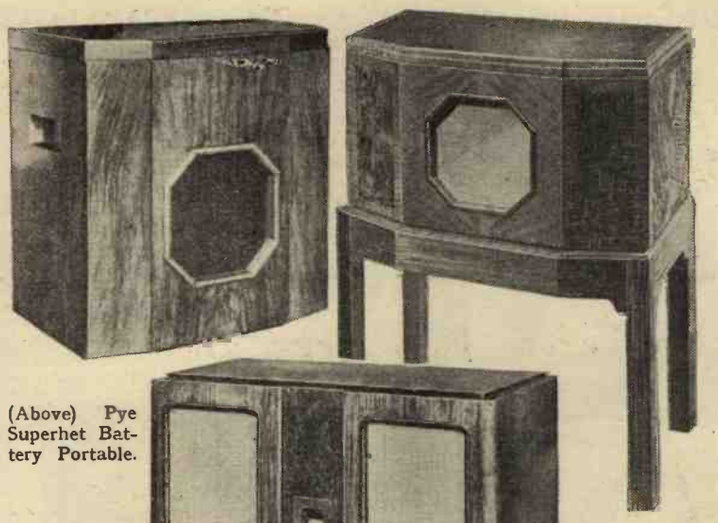


Philips Superinductance 2-HF model.

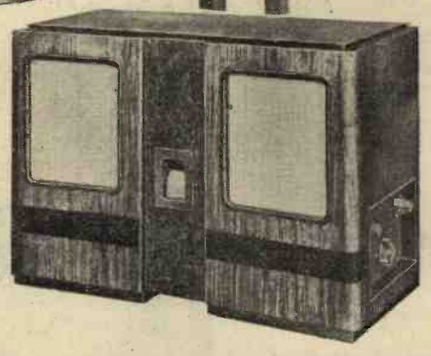
RECEIVERS: 15 GNS. AND ABOVE (*Concluded*)

R.I. Ritz Airflo.

Ultra Model 44.



(Above) Pye Superhet Battery Portable.



(Right) R.I. Twin-speaker Superheterodyne.

(Above) Pye Cambridge receiver.

lowed by a fairly conventional superheterodyne circuit. The extra valve ensures sufficient sensitivity for the reception of a good choice of programme.

A companion battery superhet portable model SP/B costs 15 guineas and is fitted with Class "B" output.

Unusual Layout

PYE CAMBRIDGE RECEIVER CR/AC — 22 gns.

Five-valve Superheterodyne for AC Mains

An unusual but very practical layout has been adopted for this receiver. The cabinet is supported at a comfortable height on legs, and all controls are mounted on the top panel, being normally concealed by a lid. The general design is plain and substantial, without conscious effort towards ornamentation.

The favourite Pye arrangement of a double-diode-pentode as second detector, AVC device, and output valve is included.

Three Controlled Valves

PYE SE/DC — 16 gns.

Six-valve Superheterodyne for DC Mains

A separate oscillator valve is one of the many unconventional features of the Pye DC superheterodyne. The action of the AVC system should be more than usually effective, as three valves are affected by the application of control voltage to their grids.

Metal Oxide Detector

PYE SE/B — 15 gns.

Five-valve Battery Superheterodyne

This may be considered as a companion model to the SE/DC set, but designed for battery supply. A Westector (permanent Westinghouse HF rectifier) is employed as a second detector, and a very considerable volume is obtained by the use of a Class "B" valve in the output position.

The Pye designers are evidently firm believers in the desirability of a signal-frequency HF stage, which again figures in this set.

Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2.

More Convenient Controls

R.I. RITZ AIRFLO — 16 gns.

Four-valve AC Superheterodyne

It has been argued that the conventional broadcast receiver does not by any means represent the last word in convenience, but few designers seem to try to improve matters in this respect. But all the more ambitious R.I. models must be excluded from this implied reproach; the controls are fitted on a sunken panel at the side of the cabinet, and it would appear that fine adjustments can be made with exceptional ease and certainty. Wave-changing is effected through a small lever—surely better than the conventional knob?

A real valve-controlled system of noise suppression is included, while improved diffusion of sound is aimed at in the design of the loud speaker mounting.

Iron-cored Coils

R.I. RITZ TWIN SPEAKER RECEIVER — 17 gns.

Four-valve AC Superheterodyne

Although the circuit of this receiver is somewhat simpler than that of the "Airflo" model, the same advanced layout of the control system is employed. Instead of the valve-operated noise suppressor, a delayed and amplified AVC system is fitted, together with tone control.

Iron-cored coils are fitted; one of the twin speakers is energised, while the other is of the permanent-magnet type.

A similar set with a single speaker costs 15 guineas.

Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

Oversize Loud Speaker

ULTRA 44 — 15 gns.

Three-valve AC Superheterodyne with AVC

This is a good example of the modern superhet circuit in which the number of valves is reduced by employing a double-diode-pentode for purposes of second detector, AVC, and output. A refinement is introduced in the form of tone compensation for the volume control; the object of this is to improve the quality of reproduction at low volume levels.

The loud speaker fitted to this model is of the oversize "Auditorium" type, and the well-known Ultra "clock-face" tuning dial is, of course, fitted.

Ultra Electric, Ltd., Erskine Road, Chalk Farm, London, N.W.3.

RECEIVERS: BELOW 15 GNS. AND ABOVE 10 GNS.

An Up-to-date Circuit

AERODYNE "SWALLOW" — 12 gns.

Four-valve Superheterodyne for AC Mains

In addition to a band-pass input filter there are four tuned circuits in the IF stage, and the input filter includes a second-channel rejector circuit. The valves are of up-to-date type, and include a heptode frequency-changer, variable-mu pentode IF amplifier and double-diode-triode second detector which is arranged to provide full automatic volume control.

Mains Regulation and Filtering

AERODYNE "CURLEW" — £10 19s. 6d.

Three-valve "Straight" Receiver for AC or DC Mains

With a band-pass input and reaction applied to the HF coupling this set should give a good account of itself in the matter of range and selectivity. Pentode-type valves are used throughout, including the detector stage, and the half-wave rectifier has two elements connected in parallel to give a low impedance. HF filtering chokes are included in the mains leads, and the filament current is regulated by a barretter.

Aerodyne Radio, Ltd., Aerodyne Works, Walthamstow, London, E.17.

Superhet with Power Grid Detection

AMPLION RADIOLUX — 12 gns.

Four-valve Superheterodyne for AC Mains

(DC Model also available: 1 gn. extra)

The typical small superhet has no signal-frequency amplifier, but always employs a separate IF valve. This order is reversed in the Amplion circuit, which includes an HF stage but no IF amplifier. Another unusual feature is a power grid detector; two Westinghouse HF rectifiers are used in connection with the AVC system.

Amplion (1932), Ltd., 82/84, Rosoman Street, Rosebery Avenue, London, E.C.1.

Twin Speaker Superhet

BEETHOVEN MODEL 56 — 13 gns.

Five-valve Superheterodyne for AC Mains

An unusual feature in a set at this price is the inclusion of a variable-mu LF pentode for interstation noise suppression. The frequency-changer is of the octode type, and the double-diode-triode detector provides delayed AVC. The cabinet design has the appearance of a single loud speaker set, but dual units are mounted behind the circular grille.

Beethoven Radio, Ltd., Camden Town, London, N.W.1.

Beethoven Twin-speaker superhet.

RECEIVERS: BELOW 15 GNS. AND ABOVE 10 GNS. (*Continued*)

"Straight" Console Receiver

BURTON CONSOLE MODEL 12½ gns.
Three-valve Receiver for AC Mains

A straightforward HF-det.-LF chassis is fitted in an upright console cabinet of ample height for convenient operation; an energised speaker is mounted below the control panel.

Power grid detection and a 2-watt output pentode are employed, and a special selectivity control is fitted.

C. F. and H. Burton, Progress Works, Bernard Street, Walsall.

Bush Radio Model SAC5.

"Quiet" AVC

BUSH RADIO MODEL SAC5 13 gns.
Four-valve Superheterodyne for AC Mains

A special circuit arrangement, in which a Westector is employed to reduce background noises in the absence of an incoming signal, is a feature of this set. A neon tuning indicator is fitted, and the built-in speaker can be switched out when an external reproducer is employed.

Drummer (Edge Radio) Model M55.

A Simpler Circuit

BUSH RADIO TYPE SAC1 £10 19s. 6d.
Three-valve Superheterodyne for AC Mains

This may be regarded as a simplified version of the SAC5, in which a double-diode-pentode replaces the metal rectifier, intermediate LF valve, and output pentode.

Drummer Model M45.

Unconventional Battery Superhet

BUSH RADIO MODEL SB1 £10 19s. 6d.
Three-valve Battery-fed Superheterodyne

An unorthodox but highly practical circuit arrangement, employing a Westector as second detector, battery economy device, and source of rectified AVC voltage, is a feature of this set. In addition, a good measure of "quiet" control is obtained; few, if any, receivers at anything like the price can claim true QAVC as part of the design.

Bush Radio, Ltd., Woodger Road, Shepherd's Bush, W.12.

Exceptionally Convenient Tuning System

CLARKE'S ATLAS 7-5-8 14 gns.
Four-valve AC Superheterodyne for External or Internal Capacity Aerial

Although the conventional receiver is admittedly susceptible to improvement on the score of convenience of operation, few designers have the courage to attempt to improve matters in this respect. But the 7-5-8 is an exception; a great deal of thought has evidently been devoted to the design of the tuning system, and an ingenious tilting tuning scale, which may be easily read, has been devised.

Four valves, including an octode frequency-changer, are used in a superheterodyne circuit, and refinements include AVC, tone control and a device to prevent distortion due to slight mistuning.

H. Clarke and Co. (Manchester), Ltd., Atlas Works, Patricroft, near Manchester.

Bush Radio three-valve superheterodyne.

For Any Mains

CLIMAX MODEL AC-DC 5 11½ gns.
Universal four-valve Superheterodyne for AC or DC Mains, 200–250 Volts (AC Model 55/W, 11 gns).

An octode frequency-changer and a pentode output valve giving from 1.75 to 2.25 watts output (depending on actual mains voltage) figure in the technical specification of the Climax AC-DC superheterodyne. Provision for cutting out the built-in speaker has been made, and there are separate medium- and long-wave tuning scales.

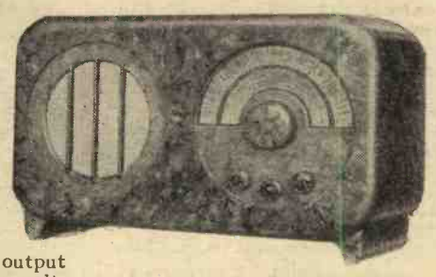
The AC model is basically similar in appearance and circuit arrangement.

Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

(Above) Ekco Universal AC/DC receiver, Model 65.

(Right) Ekco Model 85.

(Left) Atlas "7-5-8" receiver.



Neon Indicator

COSSOR ALL-ELECTRIC SUPERHET MODEL 535 12 gns.
Four-valve Superheterodyne for AC Mains

A Cossor neon tube tuning indicator and manual tone control are fitted to this model, which employs, as second detector and anti-fading regulator, a double-diode valve. This valve feeds direct into a high-slope power pentode output valve.

Inexpensive Colsole Receiver

COSSOR MODEL 356 £10 15s. 0d.
Three-valve HF-det.-LF Receiver for AC Mains. In Upright Console Cabinet

The circuit arrangement of this receiver is normal except for the inclusion of an HF pentode as a detector; this offers the advantage of reduced damping on the preceding tuned circuit, and, in consequence, less dependence on reaction and generally easier operation.

The cabinet is 34in. high, and may be accommodated easily in a room where spare table-space is lacking.

A. C. Cossor, Ltd., Cossor Works, Highbury Grove, London, N.5.

Iron-cored Coils Throughout

DRUMMER MODEL M45 12 gns
Four-valve Superheterodyne for AC Mains (Model M55, 14 gns.)

This may be described as the "standard" receiver of the series produced by Edge Radio. The specification is a full one and includes AVC, provided by a separate double-diode valve. It is interesting to note that iron-cored coils are used, not only in the signal-frequency circuits, but in the band-pass IF couplings as well.

A rather more ambitious receiver, Model 55, has a double-diode-triode second detector which provides an extra stage of amplification.

Edge Radio, Ltd., Bolton, Lancs.

The Circular Set

EKCO MODEL 65 10½ gns.
Universal Three-valve Superheterodyne for AC or DC Mains

This set is unique in that it is mounted in a circular case of moulded bakelite. This unusual form of construction is highly practical, as a large and therefore easily read tuning scale may be fitted without spoiling the appearance of the receiver. Table space is also saved.

All the normal functions of a small superbeterodyne are carried out by three valves, the operations of detection, AVC and output being combined in a double-diode-pentode.

Unconventional Externally and Internally

EKCO MODEL 85 12½ gns.
Four-valve Superheterodyne for AC Mains. Battery Model B85, same price

This is another set in the design of which a definite break with conventional practice has been made in the matter of external design. The result is a receiver that is obviously convenient to operate, and is exceptionally compact and workmanlike.

Internally the set is equally interesting from a technical point of view, as it embodies a special "quiet" AVC system; a total of six tuned IF circuits gives promise of exceptionally good selectivity.

E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex.

Guide to Receivers—

Combined Detector-Output Valve

FERRANTI AC/DC UNIVERSAL 14 gns.
Three-valve Superheterodyne for AC or DC Mains

In external appearance this set is very similar to other table models in the Ferranti series. The control panel includes a tuning indicator, and below the loud-speaker grille there is a tone control and cut-out switch for the internal loud speaker. The output valve is a double-diode-pentode and the frequency changer is a heptode. An interesting system of reflexing has been adopted in the IF and output stages. A barretter is used to compensate for fluctuations in mains voltage, and the circuit will work satisfactorily on AC supplies below 40 cycles.

The Smallest Ferranti Set

FERRANTI LANCASTRIA. 12 gns.
Three-valve AC Superhet for External or Mains Aerial

Although this set employs only three receiving valves, all the essential functions of a small superhet are carried out. Two of the valves are of the multiple type.

The output pentode is combined with a pair of diodes, one of which acts as a second detector, while the other provides control voltages for the AVC system. A tuning indicator (an unusual refinement for an inexpensive set) is fitted, and forms part of what is described as a "tell-tale" control panel, which shows at a glance what is happening with regard to the various adjustments.

Ferranti, Ltd., Hollinwood, Lancs.

Amplified AVC

G.E.C. SUPERHET AVC5 14 gns.
Four-valve Superheterodyne for AC Mains. (Model 440, 11 gns.)

Special attention has been given to the design of the AVC circuits in this receiver to obtain the maximum range of control. Reduction of background noise between stations is provided by a sensitivity switch. By virtue of the action of the AVC, powerful stations are not reduced in volume when the sensitivity control is in operation.

A silencing key is provided for the main loud speaker, and an alternative "wound-up" internal aerial is included.

Mains Voltage Regulation

G.E.C. SUPERHET, DC5 13 gns.
Four-valve Superheterodyne for DC Mains

Housed in a similar type of cabinet to the AVC5, but with a horizontal tuning scale, this model employs special indirectly heated DC valves, and is fitted with a barretter-type voltage-regulating resistance.

Sensitive Battery Superheterodyne

G.E.C. SUPERHET, AVC6 £14 17s. 6d.
Six-valve Superheterodyne with Class "B" Output

Based on the circuit of the AVC5 and housed in a similar cabinet to that of the DC5, this receiver is provided with an HF amplifier in front of the heptode frequency changer and an additional driver valve between the second detector and the Class "B" output stage. The illuminated tuning scale is calibrated both in wavelengths and in station names.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. don, E.C.1.

Popular H.M.V. Set

H.M.V. MODEL 442 13½ gns.
Four-valve Superheterodyne for AC Mains. (Model 440, 11 gns.)

This model employs the popular four-valve superhet circuit, with the addition of AVC and visual tuning, the latter in the form of a neon tube device known as a "fluid-light" tuning indicator. A good feature is the provision of separate vertical scales for medium and long wavebands.

A rather simpler AC set (Model 440), without AVC, is sold for 11 guineas (12 guineas for DC).

The Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.

An Unusual Cabinet

H.S.P. MODEL SH5 12 gns.
Four-valve Superheterodyne for AC Mains

The circuit design of this receiver follows well-established practice, and includes automatic volume control and a background-noise suppressor switch. The large illuminated tuning scale is calibrated in wavelengths, and the names of the principal European broadcasting stations are included. The cabinet is of futuristic design and is finished in walnut veneer.

H.S.P. Wireless Co., Langford Works, Weston-super-Mare.

An Unusual AVC Circuit

HALCYON MODEL 4501 14 gns.
Four-valve Superheterodyne for AC or DC Mains

Metal rectifiers are used, not only for the power supply, but also for detection and the provision of AVC. The latter is of unusual design, and the delay voltage is controlled by the signal as well as the main AVC bias. The tuning scale includes a visual tuning indicator, and an anti-interference unit is incorporated in the mains leads.

A Simple Battery Receiver

HALCYON 4-VALVE BATTERY SET 11 gns.
Band-pass Tuning and Class "B" Output

In producing this set the makers have set out to provide a simple "straight" receiver with high-grade components and workmanship throughout. A three-gang condenser is employed and band-pass tuning precedes the HF stage. The detector is followed by a driver valve and Class "B" output.

A simplified three-valve model with a pentode in the output stage is also available at £8 19s. 6d.

Halcyon Radio, Ltd., Valetta Road, Acton, W.3.

HF Instead of IF Amplification

HIGGS MODEL 55R 12 gns.
Four-valve Superheterodyne for AC or DC Mains

This is a modified version of the Model 55T with a single loud speaker, but without the visual tuning indicator. The circuit is of the type in which most of the HF amplification is carried out by signal frequency, the IF stage consisting of a tuned transformer without valve amplification.

Charlton Higgs (Radio), Ltd., Westbourne Place, Hove, Sussex

Unusual Three-valve Superhet

KOLSTER-BRANDES KB444 12 gns.
Three-valve Superheterodyne for AC Mains

An interesting example of the type of superhet that dispenses with an IF amplifying stage. HF pentodes are used as combined detector-oscillator and second detector.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Special IF Amplifier

McMICHAEL AC SUPERHET 14 gns.
Four-valve Superheterodyne for AC Mains

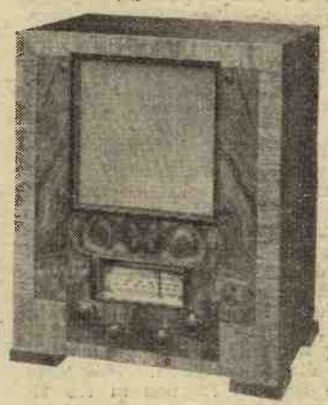
Thanks to the use of iron-cored coils as intermediate-frequency couplings, an exceptionally high degree of selectivity is claimed for this receiver.

A triode-pentode is employed as a frequency changer, and there is variable tone control. Proper provision is made for the use of external speakers.

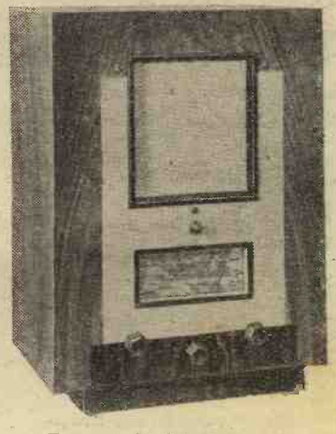
Self-contained Battery Set

McMICHAEL DUPLEX TRANSPORTABLE. 14 gns.
Five-valve Battery-fed Receiver Operating with Built-in Frame Aerial

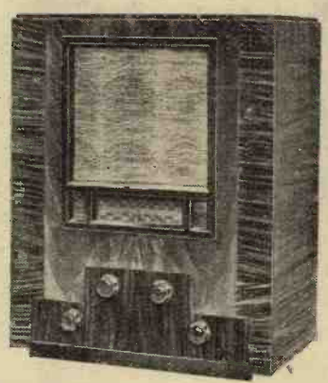
A receiver of this type is intended for moving from room to room rather than for out-of-doors use.



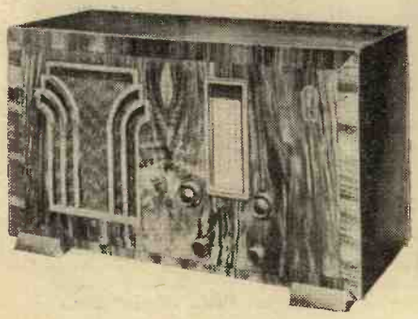
H.M.V. Superhet. Four-Forty.



Ferranti AC/DC Universal.

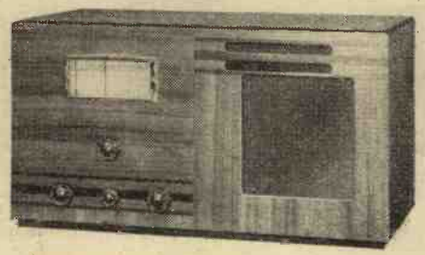


Higgs Model 55R.



(Above) Halcyon Model 4501.

(Below) H.S.P. Table Model SH5.



(Left) G.E.C. Superhet. AVC5.

RECEIVERS: BELOW 15 GNS. AND ABOVE 10 GNS. (*Continued*)

Subsidiary models, differing so slightly from those enumerated that it is unnecessary to describe them here, are produced by some manufacturers. The valve rating adopted in this Guide does not include the power rectifier.

The loud speaker is of the moving-coil P.M type, grid bias is semi-automatic, and economy in consumption of battery current is ensured by the fitting of the Class "B" output system.

McMichael Radio, Ltd., Slough, Bucks.

"Barometer" Tuning Indicator

MARCONIPHONE MODEL 296 — 13½ gns.
Four-valve Superheterodyne for AC Mains

The triode output valve in this receiver is capable of an undistorted power of 2¼ watts. Full AVC is provided and a convenient feature of the controls is that the pre-set static suppressor is brought into operation by pulling out the manual volume control knob.

Separate tuning scales are used for medium and long wavelengths, and the visual tuning indicator takes the form of a vertical column of light framed in a small escutcheon on the control panel.

Simplified Circuit

MARCONIPHONE MODEL 262 — 11 gns.
Four-valve Superheterodyne Receiver. Separate Models for AC and DC Mains

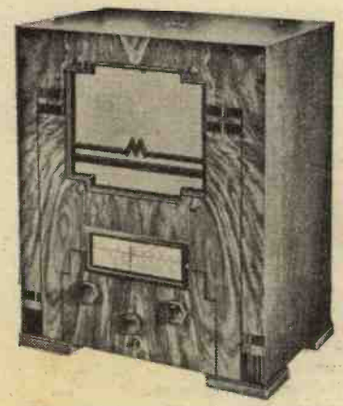
By using a screen-grid frequency changer and simple triode second detector without AVC it has been found possible to produce this receiver at a low figure. The DC version costs 12 guineas.

Two Sensitivity Controls

MARCONIPHONE MODEL 257 — 11 gns
Four-valve Superheterodyne for Battery Operation

This receiver has all the refinements of the more advanced mains four-valve superheterodyne, and its special QPP output stage is capable of delivering 1¼ watts to the permanent magnet moving-coil loud speaker. In addition to the sensitivity switch for reducing volume from the local stations, there is an extra control for raising the sensitivity above normal for distant reception. This takes the form of reaction in the IF circuits.

Marconiphone Co., Ltd., Tottenham Court Road, London, W.1.



Marconiphone Model 257 battery superhet.

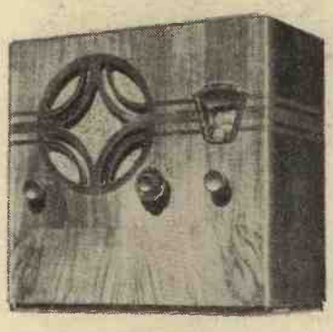
Reliability of Performance

MURPHY TABLE MODELS £14 10s.
Four-valve Superheterodyne Receivers. Separate Models for AC Mains, DC Mains and Battery Operation

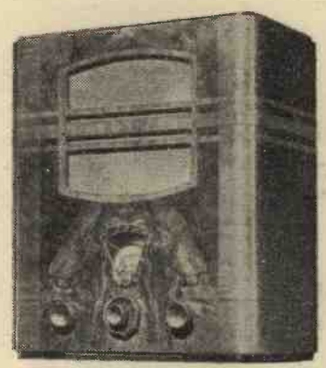
The chassis layout and mechanical design are basically the same throughout this series of receivers, and the makers have given special attention to the question of electrical and mechanical reliability.

The usual circuit arrangement of frequency changer, IF amplifier, double-diode-triode detector and pentode output valve is followed in the AC model. A separate triode oscillator is, however, added to the DC and battery models. All three models have band-pass input with image-frequency suppression and incorporate a heterodyne whistle filter between the detector and output stages. The battery model has QPP output, and the separate oscillator valve incorporates a diode which operates as a limiting device and prevents overloading of the first valve by strong signals.

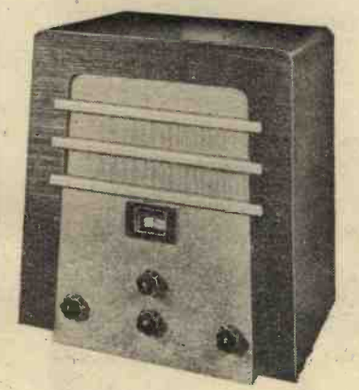
Murphy Radio, Ltd., Welwyn Garden City, Herts.



Philips 2-HF battery set, Type 372B.



The Philips Superheterodyne, Type 588.



Murphy Table Model A24.

Kilocycle Calibration

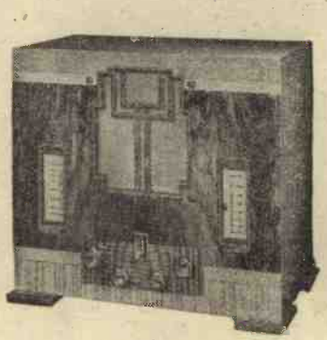
PHILCO MODEL 260 — 12 gns.
Four-valve Superheterodyne for AC Mains

One of the claims for this receiver is that the "auditorium" type loud speaker is capable of giving greater volume than is usually expected from a table model receiver of this type. The tuning scale is calibrated both on long and medium waves in kilocycles, and in the subsidiary Model 1260 at 14 guineas a shadow tuning indicator is fitted. Both models may be supplied with special mains transformers for 25-cycle supplies without extra charge.

Philco Radio & Television Corporation of Gt. Britain, Ltd., Aintree Road, Perivale, Middlesex.

McMichael AC Superhet.

McMichael Duplex Transportable.



Marconiphone Model 296.

2-HF Battery Set

PHILIPS TYPE 372B — 11 gns.
Six-valve Battery-fed Receiver

In many respects the specification of this "straight" battery set is unique. There are three tuned circuits of the high-efficiency type, with the development of which the makers' name is especially associated, and so selectivity should be of a high order. A diode—another unusual feature in a set of this type—is employed as a detector and for AVC. Overall magnification should be high, as an intermediate LF stage is followed by driver and Class "B" valves.

Pentode LF Stage

PHILIPS 588A — 12 gns.
Five-valve Superheterodyne for AC Mains (Model 588U Universal for AC or DC, 13 gns.)

The recent introduction of a Philips superheterodyne marked an important change in the policy of the makers, and in any case the design is an interesting one. A feature is the inclusion of an intermediate LF stage (with a pentode valve) which ensures full loading of the output valve on weakly modulated transmissions.

The "Universal" model is usable on any mains (AC or DC) between 110 and 250 volts.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

Inexpensive Frame-aerial Set

PORTADYNE TRANSPORTABLE PA6 — 14½ gns.
Five-valve Superheterodyne Receiver for AC Mains Operating on Built-in Frame Aerials (Battery-fed Model 13½ gns.)

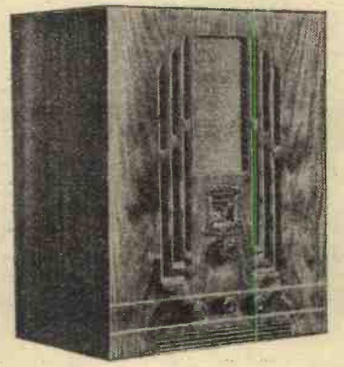
For a completely self-contained AC frame aerial receiver the price of the PA6 is distinctly low. Nevertheless, its specification is generous, including as it does a signal-frequency HF stage, AVC, and noise-suppressor switch.

The battery counterpart, with a total of six valves, is basically similar, but includes a Class "B" output stage.

Noise Suppression

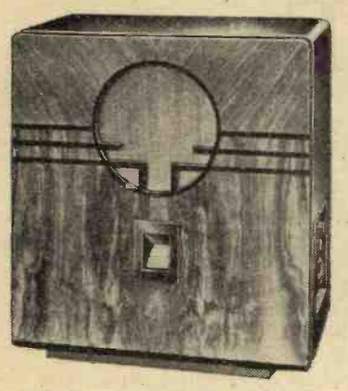
PORTADYNE MODEL A37 — 12½ gns.
Four-valve Superheterodyne for AC Mains (Battery Model B37, 12 gns.)

A rather unusual system of noise suppression is embodied in this receiver, which may be con-

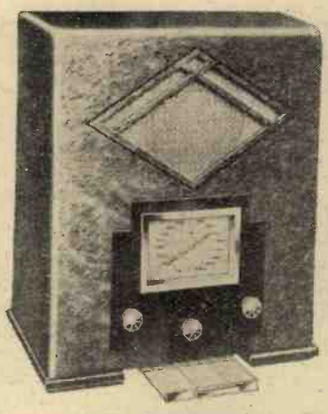


Philco Table Model 260.

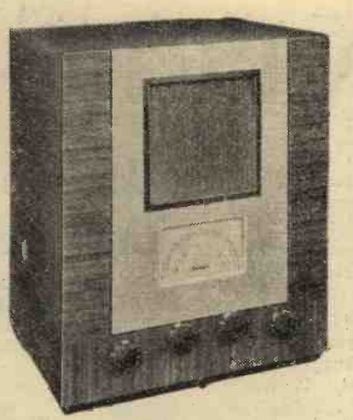
Guide to Receivers—



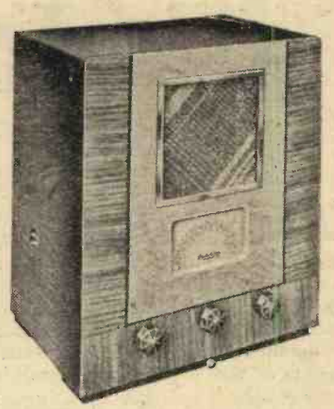
R.I. Ritz AC superheterodyne.



Ultra Model 22.



Portadyne battery set.



Portadyne PA6 frame-aerial receiver (AC mains).

sidered as the "open aerial" companion of the PA6. By operation of a switch, the initial sensitivity of the diode detector may be reduced, thus rendering the receiver unresponsive to interference below a predetermined strength and also to signals below a satisfactory "programme" level.

Both AC and battery models are fitted with AVC, and the latter includes Class "B" amplification.

Portadyne Radio, Portadyne Works, Gorst Road, N. Acton, London, N.W.10.

A Popular Portable

PYE PORTABLE RECEIVER £11
MODEL S/Q
Four-valve Battery-fed Receiver Operating with Built-in Frame Aerial

This receiver—a development of an earlier model—employs a "straight" HF-det.-2LF circuit with pentode output, and is fitted with a moving-coil speaker.

Volume control is effected by an unusual combination of reaction and regulation of the HF valve filament voltage — through, of course, a mechanically linked control operated by a single knob.

Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2.

Battery Receiver with Iron-cored Coils

R.I. RITZ MICRION 13 gns.
Four-valve Battery-fed Superheterodyne

Thanks to the use of a quiescent push-pull output stage, the total anode current consumption of this receiver has been kept down to the very reasonable figure of 8 milliamps. In view of the fact that the circuit arrangement is relatively ambitious, this is highly satisfactory. Micrion iron-cored coils and other well-known R.I. components are used throughout.

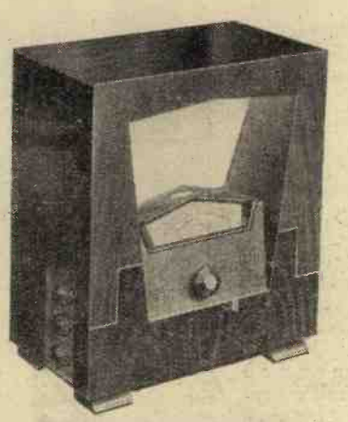
Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

"Sound Reflector" Cabinet

REGENTONE TYPE AS/45 14 gns.
Four-valve Superheterodyne for AC Mains

The loud-speaker baffle is set back from the front of the cabinet in a recess which is shaped to improve the acoustic projection of the sound. The use of a double-diode-pentode in the output stage allows the four-valve circuit to include a pentode HF amplifier. A tuning indicator is provided, and the internal loud speaker may be disconnected by means of a silencing key.

Pye S/Q portable.



Regentone AS/45 Superhet.

Simplified Controls

REGENTONE TYPE AS/35 12 gns.
Three-valve Superheterodyne for AC Mains, DC Mains or Battery Operation

The circuit is similar to that of the AS/45, but the signal-frequency amplifier is omitted. An interesting feature of the cabinet, which is of the same acoustic design as that of the more expensive model, is the arrangement of the controls; only the tuning knob appears on the front, and the subsidiary controls of volume, tone, etc., are situated in recesses at each side of the cabinet.

Regentone, Ltd., Worton Road, Isleworth, Middlesex.

Three Valves: Twenty Electrodes

ULTRA MODEL 22 12 gns.
Three-valve Superheterodyne for AC Mains (Battery Model same price; DC Model 1 guinea extra)

By the use of multiple valves in this receiver, all the usual operations of the superheterodyne principle are carried out with three valves only. Frequency-changing is effected by a triode-pentode, while a double-diode-pentode combines the functions of detection, AVC, and output. The tone of reproduction is controllable by means of a switch.

Ultra Electric, Ltd., Chalk Farm, London, N.W.3.

The Guide to Receivers will be concluded in next week's issue, which will deal with the "10 guineas and below" class. The full range of classification covered by the Guide includes, Radio-gramophones: 30 guineas and above. Radio-gramophones: below 30 guineas. Receivers: 15 guineas and above. Receivers: below 15 guineas and above 10 guineas. Receivers: 10 guineas and below.

CLUB NEWS

Reading T. and R. Society

Mr. Gerald Marcuse (G2NM) is chairman of the Reading and District Amateur T. and R. Society, which holds meetings on the last Tuesday in each month. A demonstration of a single signal superhet. was given on Tuesday, November 27th, by Mr. E. Dedman (G2NH).

New members will be welcomed, and particulars can be obtained from the Hon. Secretary, Mr. A. E. Lambourne (G5AO), 43, Bramshaw Road, Reading, Berks.

Loud Speaker Contest

Loud speaker nights, it has been discovered, are among the most popular events of the session of the Croydon Radio Society. The society recently held another loud speaker contest. After stern eliminating tests, the winning speaker was an adapted Baker Selhurst belonging to Mr. Vellacott. Hon. Secretary: Mr. E. L. Cumbers, 14, Hampden Road, South Croydon.

Short Waves and Potato Pie

Readers of *The Wireless World* will be welcomed at the Potato Pie Supper to be held by the Manchester Chapter of the International Short Wave Club. Full particulars, including price of tickets, etc., can be obtained from the Hon. Secretary, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, nr. Manchester.

An American Superhet.

An interesting single signal superhet. was demonstrated by Mr. C. H. Young (G2AK) at a recent meeting of Slade Radio (Birmingham). The receiver demonstrated was of American make and comprised ten valves including rectifier. Hon. Secretary: 110, Hillaries Road, Gravelly Hill, Birmingham.

Workshop Tips

Remarkable ingenuity in devising workshop gadgets was shown by Messrs. Griffiths and Patullo in their lecture on "Workshop Hints and Tips" at a recent meeting of the Golders Green and Hendon Radio Scientific Society.

On December 12th Mr. Matthews lectured on the "Heaviside and Appleton Layers." All communications should be addressed to the President, Mr. W. A. Hudson, 25, Llanvannor Road, N.W.2.

Tribute to Amateurs

Recent work of the Smethwick Wireless Society in the transmission and reception of short-wave signals lent special interest to the lecture by Mr. D. R. Parsons (of Messrs. Stratton and Co., Ltd.) on "Short-wave Radio Communication." In dealing with many aspects of short-wave work, the lecturer paid tribute to the work of the amateur movement. Hon. Secretary: Mr. E. Fisher, M.A., 33, Freeth Street, Oldbury, nr. Birmingham.

INTERFERENCE

Common Causes and Methods of Suppression

A USEFUL definition of interference so far as it relates to broadcast reception would be anything that is emitted from the loud speaker that does not originate at the transmitter. This covers a very wide field, but it should be given due consideration since every sound not transmitted from the studio must in one way or another detract from the full enjoyment of the broadcast programme. Whilst we cannot hope yet to achieve this ideal, for the receiving equipment itself is far from perfect and even the most up-to-date transmitters have some imperfections, it should at least be possible to make the reproduction a tolerably good replica of the original, provided there is no troublesome background noise. Unfortunately, in suppressing the background we may have to curtail the frequency response of the receiver, but there are other types of interference that can be eliminated, or at least reduced to a level where they do not obtrude, without materially affecting the characteristics of the receiver.

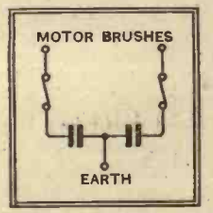


Fig. 1.—Simplest condenser arrangement for an electric motor.

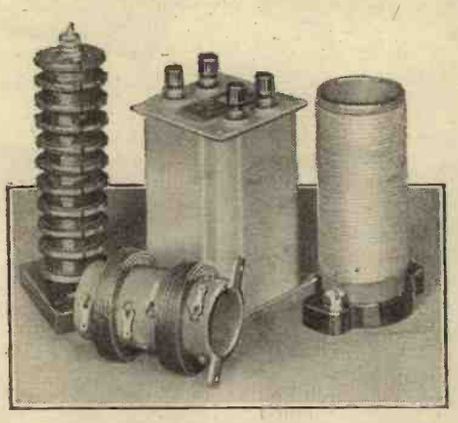
Interference to which radio receivers are prone might be classified broadly under three headings: (1) Atmospheric disturbances; (2) man-made static; (3) inter-station interference.

So far as (1) is concerned, there is at present no known remedy for it on broadcast, though something can be done to achieve a high signal-to-noise ratio in commercial receivers where single signal reception of CW is applicable. This, however, is outside the scope of the present article.

Likely Causes

Fortunately, atmospheric interference is not really troublesome during the periods of the year when we rely most on our wireless sets for entertainment, and as in any case nothing can be done to suppress it we might as well accept the inevitable and give attention to those forms that are amenable to treatment.

Practically every piece of electrical machinery, scientific and commercial apparatus, is a potential generator and radiator of electrical disturbances, and the majority include a high-frequency component often modulated by low-frequency disturbances falling within the audible range covered by a broadcast set. These electrical radiations may be picked up by the aerial or conveyed direct to the set by the supply mains, but more often by a combination of both.



Special heavy-duty HF chokes for including in mains supply to receivers.

So far noises generated in the set itself, either by faulty parts or poor design, have not been taken into account, and indeed will not be dealt with here, since a dissertation of the causes, effects and remedies is really a matter for separate treatment, yet these possibilities must not be overlooked should there appear a noisy background in a set having given satisfactory reception for some time.

Inter-station interference can, as a rule, be avoided, though some sacrifice in quality of reproduction may be entailed. It usually takes the form of heterodyne whistles, varying in pitch between about 5,000 c/s and 9,000 c/s, and is brought about by the carrier waves of stations occupying adjacent channels heterodyning, and sometimes by the harmonics of stations quite widely separated. In superheterodynes there is occasionally encountered what is described as sound channel heterodyne, where two stations are separated by approximately twice the IF frequency provided the resultant beat note falls within the range of the LF amplifying equipment. By suitable design this trouble has been largely eliminated in modern sets though it may be encountered in some older models, and the remedies will be dealt with a little later in this article.

Mains-borne Interference

Interference falling under the second main heading, namely, man-made static, is perhaps the most common, and incidentally presents the biggest problem of all, as its origin is difficult to trace, and having been located may not be possible of treatment at the source.

Electrical appliances on the premises of the listener, such as motors, vacuum cleaners, refrigerators, and the like, can usually be silenced by fitting a pair of condensers across the brushes as in Fig. 1, where a commutator-type motor is used, the junction of the two condensers being earthed; as a safety measure a fuse in each lead is advisable.

More often than not the interference emanates from electric plant some distance away, the electrical disturbances being conveyed along the supply mains, where it may be radiated from the house wiring or introduced into the set *via* the mains transformer.

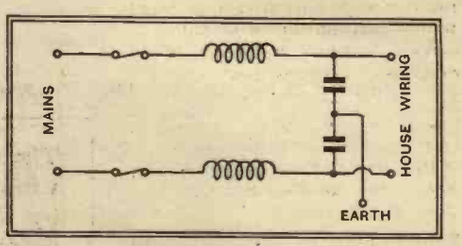
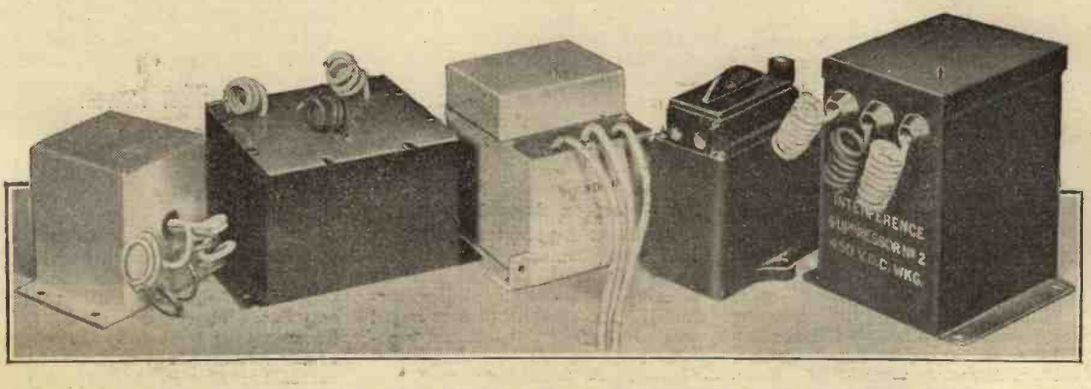


Fig. 2—Arrangement of a choke-condenser filter for suppressing mains-borne interference.

A filter unit consisting of an HF choke, or an inductor as it is sometimes termed, in each lead with a pair of condensers arranged as in Fig. 2 will prevent these currents circulating in the house wiring, but in many cases the simple array of condensers as shown in Fig. 1 will suffice. This type is comparatively easy to fit, as where chokes are used they must be included in series with the mains and would have to carry the full current load of the house. A filter of this nature, however, could be included in series with the mains supply to the receiver, and other safeguards taken to avoid pick-up by the aerial.

Unfortunately this does not always effect a complete cure, since radiation may be taking place from the wiring



Condenser units for interference suppression, showing Bulgin, Dubilier, Goltone, Belling-Lee, and T.C.C. models.

Interference—of neighbouring dwellings, and if any part of the aerial system comes within the zone of interference the receiver will, of course, reproduce the noises.

It should be remembered that the aerial system not only includes the wire from the aerial terminal of the set to the free suspended end, but also the earth lead, and this is a point often overlooked. The earth lead alone makes quite a fair aerial, often little less effective than a wire run round the picture rail, as anyone can prove for their own satisfaction by disconnecting the aerial and the earth leads and joining the latter to the aerial terminal.

Special cowl fitting designed for Goltone metocel and multi-shell screened air-spaced down leads.

Consequently, if the earth wire picks up broadcast signals it will be affected also by radiation from nearby electric cables, also water and gas pipes should these in turn be acting as distributors of interference due to being in close juxtaposition to supply cables at some point.

Much can be done, therefore, to improve the signal-to-noise ratio by careful attention to the layout of the aerial system. Where facilities allow the horizontal span of the aerial can be raised well above roof level and as far away from the building as possible. The down-lead must be kept clear of gutters, and as it must pass through the zone of interference consideration might be given to the installation of shielded cable. Some of the screened down-lead systems now available utilise impedance matching transformers, one being fitted at the junction of the horizontal span and the down-lead, while another is located close to the receiver. There is another style that dispenses with these, the cable being of large cross-section, and with the down lead well spaced from the metal sheathing to keep the capacity small; a high capacity to screening along the length of the down lead would, of course, lead to considerable loss in signal strength, yet some reduction can be tolerated if the interference is lowered to a far greater extent than the signal, for then the reserve sensitivity of the set, and most modern sets have quite an appreciable reserve, will make good the aerial loss and give adequate volume with a lower background of interference.

In conjunction with this fitting attention should be given also to the earthing system, and if a water pipe has served hitherto a new point of contact should be found. An earth plate, or one of the copper earth tubes now available, will

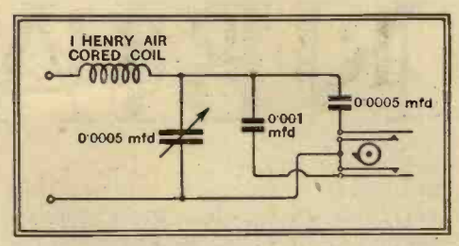


Fig. 3.—Circuit arrangement of a variable heterodyne whistle filter.

make a most satisfactory alternative, though to be really effective for the present purpose its position is rather important. Obviously no advantage is to be gained by sinking it in the ground close to the point of exit of the electric cable, water or gas pipes, and a position some six to ten feet from the building and well clear of the public services cables and pipes should be chosen. A stout copper wire, not smaller than 16 SWG, should be employed for the earth lead, and good connections throughout are essential.

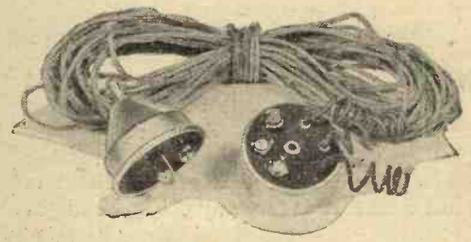
Even these changes may fail to remove entirely the interference, but a decided improvement should be effected; the residue will most likely be due to direct introduction from the mains, and a filter unit, as mentioned earlier in this article, should then give reasonably trouble-free reception.

Interference due to heterodyne whistles can be eliminated by fitting a low-pass filter with a cut-off just below the frequency of the heterodyne. This entails the loss of all frequencies above the cut-off of the filter and the reproduction will be impaired to some extent, but since only the higher range of the treble is affected broadcast will be more enjoyable with the curtailed frequency band free from the interference than the full range with a whistle superimposed.

Dubilier filter unit for interposing in mains lead to receiver and Belling-Lee flashing-sign suppressor.

A filter that will extract the whistle yet leave the higher frequencies intact can be devised, and a unit for this purpose was described in *The Wireless World* of October 28th, 1932. The circuit is reproduced in Fig. 3, and it has a range of from 4,000 c/s to 9,000 c/s. It can be joined either in parallel with the primary of an LF transformer if one is used or connected across the loud speaker terminals.

The subject of interference suppression can be dealt with only very briefly in the present article, as it can be seen that there are so many likely causes, all of which may have to be taken into account in some cases. Even the apparently most hopeless situation can be eased by the adoption of some or all of the remedies suggested here and reception at least made tolerable even though a complete cure cannot be effected.



Radiotormer screened aerial down-lead system embodying impedance matching transformers.

KELLY'S ENGINEERING DIRECTORY

THE 1934 edition of this Directory contains the names and addresses of those engaged in the various trades indicated by its title, both the manufacturing and selling branches in England, Scotland and Wales.

The following headings (selected from a total of some 1,850) should give an indication of the wide scope of the information supplied:—Aerial Ropeway Contractors; Boiler Makers; Colliery Proprietors; Cycle Agents and Dealers; Electrical Instrument Manufacturers; Gas Works; Ironmongers (both wholesale and retail); Motor Car Manufacturers; Motor Engineers and Garages; Rabbit Vermin Trap Manufacturers; Railway Plant Contractors; Steeplejacks; Safety Razor Makers and Tool Dealers.

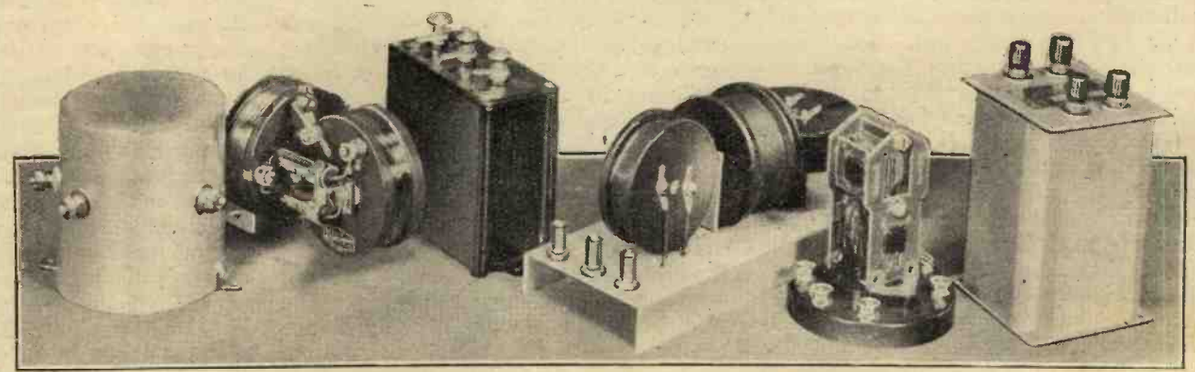
The book comprises, amongst a vast amount of other material, the following information:—

(1) The names for each county, arranged alphabetically under the towns and villages.

(2) An alphabetical classification of trades for the London postal district, with the names arranged under each trade heading in alphabetical order.

(3) A similar classification of trades for the rest of England, Scotland and Wales.

The price of the book is 45s. post free.



Selection of heterodyne whistle filters showing Postlethwaite, Wearite, Goltone and Bulgin models.

Refreshing to hear.

UNBIASED

By

FREE GRID

Disarming Statement

VERY refreshing it was the other night (November 14th to be exact) to hear a B.B.C. announcer disarmingly state that his knowledge of the Polish language was elemental and that erudite listeners must therefore excuse any bricks he might drop.

Although my own knowledge of Polish is no better than it ought to be, being confined to the correct pronunciation of the words for beer and other necessities of life, it was sufficient for me to be able to appreciate the gallant stand which he put up in the face of fearful odds.

This frank and straightforward attitude to the difficulties of a comparatively little-known language is in marked contrast to the usual attitude of the B.B.C. announcing officials, who adopt an air of superiority and seek to convey the impression that they are equally at home in all European tongues. As I have previously pointed out, they only succeed in making themselves ludicrous when they drop a cartload of bricks, such as invariably happens when they embark upon the quicksands of the Portuguese tongue, which, imagining it to be a sort of Spanish dialect, they pronounce accordingly.

Grist to the Mill

I MUST confess that as a result of a task well and truly carried out and profits well and truly earned I am feeling an inward glow of satisfaction at the present moment. It is seldom that opportunity comes my way to bring a little extra grist to the mill, and when it does, I, not unnaturally, take full advantage of it.

Doubtless many of you wondered why it was that the use of loud speakers was forbidden at certain places along the route of the Royal Wedding procession. Now that the event is over I do not mind confessing that this was due to a little judicious wire-pulling on my part.

I therefore invested in a few gross of headphones and a couple of dozen of the super-lightweight headphone portables which were shown at Olympia this year. Thus equipped, Mrs. Free Grid, the little Grid Leaks and myself, took up our seats at widely different parts of the route and were soon doing a roaring trade in headphone hire at a dollar a time. No difficulty was encountered in disposing of the whole of our stock, and my only regrets were that I had not asked a greater price. This is not, I fear, a thing which we can hope to repeat on future occasions of national rejoicing, because doubtless the idea will be plagiarised. However, I must not grumble, as I have made enough to pay off the instalments on the baby's pram and buy myself a new hat.

Batteries and Breakdowns

HOW surprising to learn from a well-known daily paper that owing to recent breakdowns in the grid-system of electric power distribution, enormous boosts have been given to the sale of batteries and battery sets. Frankly, I quite fail to understand the mentality of people who endeavour to get round the inconveniences of an electric power failure in this prehistoric manner.

The veneer of civilisation is, in their case, so thin that a superficial breakdown of one of its manifestations causes them to go right back to the atavistic customs of their ancestors. One might just as well revert to the playful habit of eating one's grandmother because of a temporary meat shortage. The sort of people who think the battery is an essential substitute in a mains set when the power supply fails are, I fear, the very ones who would seek

My own house is equipped.

to forestall an electric lighting failure by having gas laid on as well.

Needless to say, my own house is equipped with a diesel-engine generating set to deal with any such emergencies as a failure of the electric supply. The whole thing is entirely automatic, so that I am quite unaware when the town supply fails, as, when this happens, relays come into operation and instantly switch me over to my home generating station.

I am not suggesting, of course, that the diesel engine starts off with a jerk and attains full speed instantaneously. The whole thing is, of course, kept running constantly so that the relays have only to change over the electrical connections from external mains to internal generator.

To those thick-skulled people who might enquire whether I would not find it simpler and cheaper to keep a large battery of house-lighting accumulator cells in place of the diesel generator I can only reply that so far I have found the alternating-current type of cell thoroughly unsatisfactory.

More AVC

IT is an old saying that necessity is the mother of invention, although judging by the money which inventors waste on perfectly futile "inventions" I find it hard to believe that there is any great need among the inventors. Certain brilliant exceptions among the inventions which I encounter in the course of a busy life do temporarily restore my fast-waning faith in the human race.

A friend whose house is situated on a busy street with a bus stop just outside his front door and a main railway line running at the rear of his premises has long been perturbed by the noise of passing buses and trains, which well-nigh drowns out his reception. He first tried the effect of installing what my journalistic friends are fond of calling a "powerful" set and running it with wide-open throttle, but although this was successful in making itself heard over the hullabaloo outside, it was extremely distressing in its loudness during those fragrant moments when buses and trains were not passing.

My friend, therefore, conceived the idea of placing a microphone in a concealed position near his front gate, this device being coupled up to the grid circuit of a valve. This in its turn was connected to the set in such a manner that when the microphone was excited by the noise of an approaching bus, the valve tended to send a current through the load resistance of the AVC diode in opposition to the normal AVC current, thus partly cancelling it and so increasing the volume.

The cancelling effect is, of course, strictly proportional to the sound reaching the microphone at any given moment, and thus the device is suitable for mitigating the evil effects not only of motor buses but also of small boys, tom cats and other noisome fauna in strict accordance with the amount of the latter at any given moment.

BROADCAST BREVITIES

By Our Special Correspondent

Empire Broadcasting Mystery

FOUR months ago Mr. Eric Fogg flung up an important job as Music Director at the Manchester studios, and, disappointing thousands of children who enjoyed "Uncle Eric's" contribution to the Northern Children's Hour, came to London to establish and direct the B.B.C.'s All Night Empire Orchestra.

Where is Mr. Fogg and where is his orchestra?

Flesh or Wax?

Are we to believe that the "orchestra" is nothing more than a pile of gramophone records? Some still argue that it is a flesh-and-blood affair with at least sixteen performers. If this be true, they must be the most modest set of men in Broadcasting House. No listener in this country has ever heard them, they are never "In Town To-night" and they are never mentioned in the publicity notes issued by the B.B.C.

And yet we know that Mr. Fogg exists.

Ku-Klux-Klan

It is rumoured that Mr. Fogg's reticence is due to the fact that he wishes his orchestra to establish a reputation before details of its *personnel* are published. But how can any reputation be established by these Ku-Klux-Klan methods?

Ironical Fact

Listeners in this country are helping to pay for the Empire service and are entitled to hear the orchestra which they are supporting. There is real irony in the fact that the orchestra can be heard at present only by the people who are not paying for it!

Anti-Static Conference

THIS month the anti-interference experts, including B.B.C. engineers, are meeting in Berlin to arrive at a common basis of noise measurement.

I hear that the Germans are very anxious to point out that most forms of R.M.S. meter connected in parallel with a loud speaker give readings which bear little relationship to the amount of annoyance caused by noises in the speaker.

Those Clicks

Continuous interference is easily measured, but sudden clicks, however great or small their intensity, are much more difficult to deal with. Besides, we all know that continuous hum, even of considerable volume, is less annoying than intermittent crackles of low volume.

Eddie Cantor on Guest Night?

EDDIE CANTOR will probably appear at the microphone during a Henry Hall guest night. The little man with the big eyes will have landed in this country when these notes are read and I have no doubt that by then Henry will have concluded arrangements by wireless.

I wish Mr. Eustace Robb, the television chief at Broadcasting House, could induce Eddie Cantor to appear before the television transmitter, otherwise we shall miss those swivel eyes.

Winter Proms: B.B.C.'s Ambition

WILL the Winter Proms become an essential part of the Christmas holidays, like the pantomimes and circuses? This is the B.B.C.'s ambition.

This year Sir Henry Wood will again be in command at the Queen's Hall for the little season, lasting from Monday, December 31st, to the Saturday, January 12th. The programmes will be of exactly the same type as those of the Summer Proms—Wagner on Mondays, Beethoven on Fridays, miscellaneous on Saturdays, Brahms and British music sharing the Thursdays.

All Concerts Broadcast

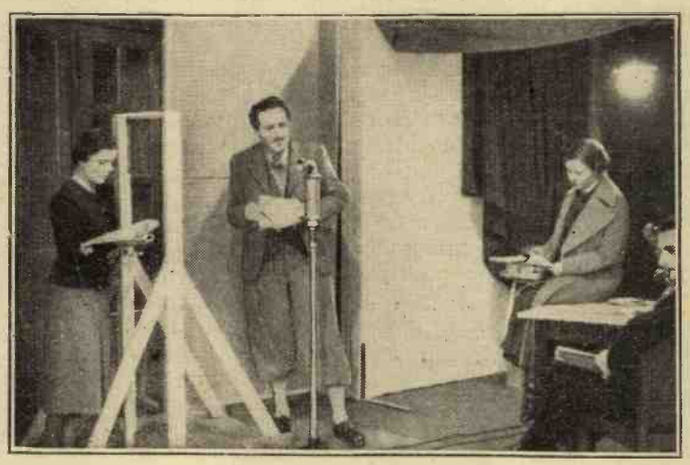
A special feature this year will be the celebration on the Wednesday evenings of the approaching 250th anniversaries of the births of Handel and Bach.

All the concerts will, of course, be broadcast from one or other of the B.B.C. stations.

Mr. Cock's Portable Set

IN case of emergencies two special circuits will be used between Sandringham and London during the King's speech at Christmas. One line will be via Nottingham and the other via Norwich.

Mr. Cock, the "O.B." Director, is taking his portable set down to Sandringham and will probably be the nearest listener at the time of His Majesty's Empire talk. Mr. Cock believes in the radio check, and will pick up the broadcast via Droitwich.



RADIO DRAMA IN GERMANY still lacks the specialised technique of the B.B.C. play. In this picture, taken during a radio play at the Deutschlandssender, the setting is an improvised room with screens and draping. Note how Paula Werrely opens the "door" to enter the room!

Alabama or Aberdeen?

SCOTS music and the B.B.C. don't mix, according to Mr. D. H. M'Neill, vice-chairman of the Scottish Nationalist Party.

At an Elgin concert Mr. M'Neill alleged that the B.B.C. were among the worst sinners in the country so far as Scots music was concerned. Their time was deplorable; it was too fast; and he sometimes wished the directors of the B.B.C. orchestras could be made to dance to their own time. The rhythm might be the rhythm of Alabama, but it was not Scottish.

New Welsh Studio

THE purchase of a private house in Bangor for a new Welsh studio, which has just been decided upon, involves a land-line stretching across Wales from North to South as far as Cardiff.

The Welsh have fought hard and long for an extra studio, but until they have a transmitter of their own I much doubt whether they will be really satisfied. A hundred studios are of little use if there is only one transmitter.

Scottish H.Q.

PROBABLY the B.B.C. will never cease to extend its property. It is now embarking on a scheme for enlarging the Scottish headquarters at 5, Queen Street, Edinburgh. The existing studios are to be given special acoustic treatment, one new studio will be constructed, and the entire building will be redecorated.

It is now four-and-a-half years since the removal from George Street to 5, Queen Street. According to the tradition of the Corporation, steps were immediately taken to acquire the neighbouring building, No. 6, Queen Street, which is now part of the Scottish broadcasting headquarters.

Developments in 1935

ON December 29th (Regional) experts will attempt to prophesy 1935 developments in their own respective spheres. Mr. J. L. Hodson will compère a programme in which Mr. R. A. Watson Watt will attempt to foretell the weather for 1935.

Traffic and Air Problems

Sir Malcolm Campbell will prophesy what he thinks will be the outcome of the traffic problem, while Geoffrey Crowther will foretell the trend of economic development. Ritchie Calder is going to deal with how 1935 will affect medical science. It is hoped to obtain the forecast of C. W. A. Scott, the winner of the Melbourne Air Race, as to the developments of fast inter-Empire Air Service.

The New Volume Control

A MAN who has discovered a new method of volume control has written to the B.B.C. in these words: "By wrapping set and loud speaker up in rugs and covering it with cushions, the noise is toned down so that I can just manage to listen to the noise."

FOUNDATIONS OF WIRELESS

IV.— High-frequency and Alternating Currents

IN this instalment consideration is given to the chief characteristics of alternating currents, the derivation of RMS values and the relationship between peak AC power and effective power are explained.

By A. L. M. SOWERBY, M.Sc.

(Continued from page 480 of December 7th issue.)

IN addition to the steady *direct current*, which flows always in one direction, the wireless engineer has to deal with *alternating currents*, the chief characteristic of which is that they flow first in one direction and then in the other. The change of direction may be relatively infrequent, as in ordinary A.C. mains (some 50 cycles per second); fairly rapid, as in the case of currents representing the air-waves that make up speech and music (50 to 8,000 cycles per second); or very fast indeed, as in currents producing or derived from wireless waves (50,000 to 30,000,000 or even more cycles per second). The last are the high-frequency currents with which we shall primarily have to deal.

Our first approach to high-frequency currents will be based on the points discussed in preceding articles of this series, and will make use of the properties of resistance, inductance, and capacity. In Fig. 14 there is shown a coil L connected in parallel with a condenser C, making a closed circuit. A battery B is connected across the whole, the battery-circuit being made and broken as required by the key K. In addition, there is a resistance *r*, compared with which the resistance of the coil will be regarded as negligible, since L is to be thought of as wound with heavy-gauge wire.

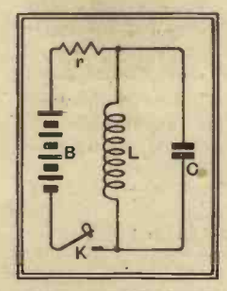


Fig. 14.—With the aid of this simple circuit the nature of high-frequency currents can be elucidated.

If K is depressed, closing the battery-circuit, a current whose magnitude will primarily be determined by the voltage of the battery and the value of *r* will flow through the coil L. This current will create a magnetic field round L, so that the state of affairs while the current is flowing may be represented by Fig. 15, which shows the field in dotted lines.

At the instant when the current is interrupted again by lifting K, the magnetic field contains stored energy. While the field is in process of collapsing it tends to maintain through L a current in the same direction as that which has just been interrupted. This current flows into the condenser C, which thereby becomes charged as indicated in Fig. 16. The absence of magnetic lines round the coil in this figure indicates that the state of affairs represented corresponds to the moment of cessation of current, the whole energy of the magnetic field having been transferred in the form of charge (displaced electrons) to the insulating material or dielectric separating the plates of the condenser.

Clearly this is not a stable condition; the condenser will now discharge through L, driving through it a current in a direction opposite to that of the current originally provided by the battery, and building up anew the magnetic field, though now with its north and south poles interchanged. When the condenser is completely discharged, as indicated in Fig. 17, the current in the coil is at its greatest value, and the energy drawn out again from C is once more in the form of a magnetic field round L. Just as before, the field now takes over the duty of driving the current in the same direction, until it has totally collapsed, thus transferring the energy once more to C in the form of a charge but opposite in polarity to that shown in Fig. 16.

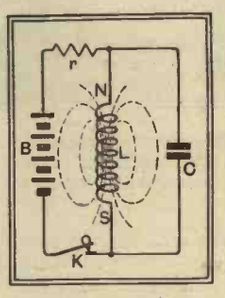


Fig. 15.—The circuit of Fig. 1 with the key K closed. Note the magnetic field round L.

If it were not that the circuit LC contains resistance in one form or another—for example, the resistance of the wire with which L is wound—the coil and condenser would continue for ever to play battledore and shuttlecock with the original supply of energy, and the current would never cease surging in and out of the condenser, travelling backwards and forwards through the coil for all time. In practice, of course, the resistance of the coil would dissipate the energy available in the form of heat after very few interchanges.

The Sine-wave

Later, we shall see that it is possible to supply energy to a circuit of this kind in such a way as to overcome this loss and maintain the oscillations at a steady strength. It is customary to represent such maintained oscillations of current by a "sine-curve" of the type shown in Fig. 18.

In this figure, lapse of time is indicated by distance from the left of the diagram, while magnitude and direction of current are shown by vertical distance from the line OBD, the height of which indicates zero current. A dot anywhere on the surface of the paper would thus mean a certain current at a certain time, while a series of dots could be obtained by following the variation of a changing current from instant to instant. If we were to follow the current in the oscillating circuit LC of Figs. 14 to 17, making the assumption that the oscillation is maintained, we could mark in dots corresponding to a number of instantaneous measurements, and then join up the dots with a continuous curve to fill in the gaps. The result would be a curve like that of Fig. 18.

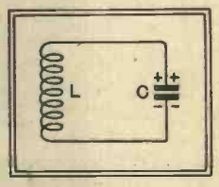


Fig. 16.—The collapse of the magnetic field round L has caused a current which has charged C.

On the diagram, A represents the moment of maximum current, when the magnetic field of the coil is at its greatest. From A to B the field is collapsing and the current is decreasing, until at B the current is zero and the condenser fully charged. At B the current reverses as the condenser begins to discharge again, the reversal of direction being shown by the fact that the curve now goes below the zero-line OBD. At C the current has again reached its maximum value, while the charge on the condenser is gone. So the process continues until E is reached, when conditions are an exact duplicate of those existing one cycle earlier at A.

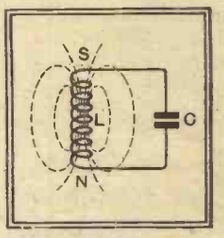


Fig. 17.—The discharge of C has driven a current through L, evoking a magnetic field opposite in polarity to that of Fig. 15.

The curve is thus a faithful record of the flow of current in the circuit, but it

Foundations of Wireless—

must not be regarded as depicting the physical shape of anything, except in a purely mathematical sense. It conveys merely that the current varies with time in the manner shown, flowing first in one direction and then in the other. The steepness of the curve at any point indicates the rate at which the current is growing or decaying at that instant. The same

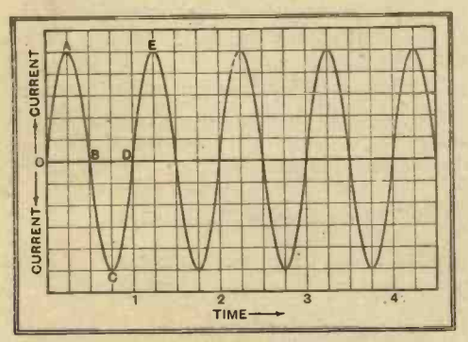


Fig. 18.—A curve showing the variation of the current in an oscillating circuit with time.

curve can also be used to indicate the voltage across the condenser C, which rises and falls according to the same law as the current. It is interesting to note that if the vertical position of a freely-swinging pendulum be regarded as corresponding to zero voltage (no tendency to fall) and if displacements to left and right be represented as above and below the line OBD, the same curve can be used to express its motion when swinging. An accurate mental picture of the flow of current in an oscillating circuit can therefore be acquired by watching a pendulum and allowing the imagination a little disciplined freedom.

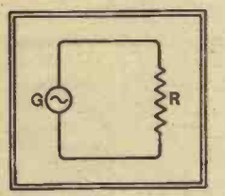


Fig. 19.—A high-frequency or alternating voltage is applied by the generator G (nature unspecified) to the resistance R.

In Fig. 19 G is assumed to be a source of high-frequency alternating voltage, driving a high-frequency current through the resistor R. We have already seen that a resistance offers opposition to the flow of current, but is indifferent to changes in that current. Put differently, the sudden application or withdrawal of a voltage produces *instantaneously* in current of the magnitude that Ohm's Law predicts. If therefore the full-line curve of Fig. 20 is taken to represent the variations of the voltage of G with time, the current will follow a curve identical in shape, though different in scale, for the current at any instant will be equal to the voltage divided by the resistance. The current curve is shown dotted.

The alternating current suppiled for house lighting has, as a general rule, a frequency of 50 cycles per second. In terms of Fig. 18, this means that the time-scale is such that the distance A to E represents one-fiftieth of a second. Each second thus contains 50 current-pulses in each direction, so that if the temperature of its filament could change quickly enough a lamp connected to such mains would not emit a continuous light, but a series of separate flashes succeeding one another at the rate of 100 per second.

How are electric mains that behave in this fashion to be rated?—that is, what are we going to mean when we speak of "200-volt 50-cycle mains"?

The convention that has been arrived at is based on comparison with direct-current (D.C.) mains. It is obviously going to be a great convenience for everybody if a lamp or a fire intended for a 200-volt D.C. system should be equally suited to alternating mains of the same nominal voltage. This condition will be fulfilled if the *average power* taken by the lamp or fire is the same for both types of current, for then the filament will reach the same temperature and the cost of running will be the same in the two cases.

Average Power

In Fig. 20 both voltage and current are shown for a resistive circuit. At any instant the power being consumed is given by the product of voltage and current. At the instant corresponding to P both are at their maximum value, and the power dissipated is also at its highest. At Q voltage and current are both zero; so also is the power. The average power must lie somewhere between these extremes.

If we described mains whose *peak* voltage (point P) was 200 volts as "200-volt mains" the maximum instantaneous power drawn by a lamp or fire would be the same as the power it would take from 200-volt D.C. mains, but the *average* power would be less. To raise this to the figure for D.C. mains, the peak voltage of the A.C. supply will evidently have to rise well above the rated nominal voltage.

It can be shown mathematically that for a curve ("sine-wave") of the form shown in Fig. 20 the average power is exactly half of that corresponding to the instant P; it is therefore $\frac{1}{2}e^2/R$, where e is the peak voltage and R the resistance of the lamp or fire. For D.C. mains of voltage E the power taken would be E^2/R watts. Alternating mains have thus to be

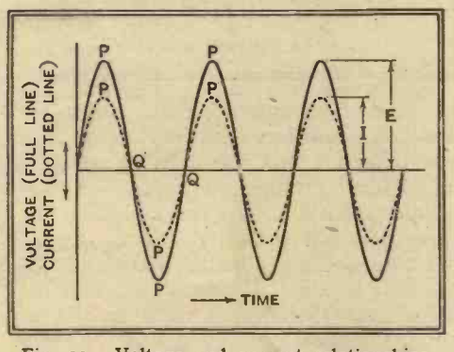


Fig. 20.—Voltage and current relationships in the circuit of Fig. 22. The average power over one complete cycle is $\frac{EI}{2}$, or half the power developed when E and I both have maximum values.

rated on the basis of a voltage E, such that E^2/R gives the power consumed if we want the lamp or fire designed for 200 volts to work equally well with mains of either type. The peak voltage e must therefore be related to the nominal voltage E in such a way that $e^2 = 2E^2$, or $e = \sqrt{2}E$.

Alternating mains equivalent to 200-volt D.C. mains must therefore rise to a peak of $200\sqrt{2} = 282.8$ volts. Such mains are described as having a *virtual* or R.M.S. (root-mean-square) voltage of 200.

If a fire of 40 ohms resistance is connected to such mains the R.M.S. current will be $200/40 = 5$ amps., and the power consumed will be $EI = 200 \times 5 = 1{,}000$ watts. Although the power is rapidly varying between a peak value of 2,000 watts and zero, both the power consumed and the heat to which it gives rise will be exactly the same as if the same fire were connected to 200-volt D.C. mains.

Using in this way R.M.S. values for voltage and current we can forget entirely the rapid variations taking place, and so long as our circuits are purely resistive all calculations dealing with alternating current can be carried out according to the rules already discussed in connection with ordinary direct current.

American Service Receivers

IT is claimed that, "when contrasted with the latest U.S. Army receivers the usual broadcast set is as a carving knife compared with the finest razor. For the Army receivers are capable of slicing a 10-kilocycle band, which is looked upon in usual broadcast practice as the limit of selectivity division, into ten channels if necessary."

A consignment of these sets has just been accepted by the U.S. Army authorities. They are designed for the reception of both CW and speech, and for the former purpose the cut-off is so sharp that the frequency band is reduced to a width of only 1 kc. According to reports, the receivers are capable of receiving signals from a distant transmitter operating on a frequency differing by only 4 per cent. from that of a station a mile away, of which the field strength at the receiver amounts to 2 volts per metre.—*Communication and Broadcast Engineering*, New York, U.S.A., October, 1934.

THE RADIO INDUSTRY

THE latest list of Wavemaster condensers, condenser drives, etc., describes an interesting variant of the "clock face" tuning dial. This is arranged on the twenty-four hour plan. Issued by Webb Condenser Co., Ltd., 34, Hatton Garden, London, E.C.1.

Leaflets describing Kabi hum balancers, multi-contact switches and midget potentiometers, have been received from F. W. Lechner and Co., Ltd., 61, Spencer Street, Clerkenwell, London, E.C.1.

Another public loud-speaker demonstration is to be given by Voigt Patents, Ltd., at The Courts, Silverdale, Sydenham, London, S.E.26, at 7.30 p.m. on December 18th. Readers are invited to attend, and are advised to reserve seats by telephone (Sydenham 4114).

Short Waves and the Amateur

By G2TD and G5KU

The Cause of Poor Receiving Conditions

IN view of the accepted Heaviside layer explanation for the transmission of the longer-distance signals, it is difficult to reconcile the unusual variations experienced on the shorter waves with the consistently good behaviour of medium waves. The day-to-day variations are, at times, enormous for even a relatively short route, such as Europe to America. There must be either a rapidly increasing dependence on the reflecting powers of the Heaviside layer as the shorter waves are approached, or else a different mechanism is necessary for their transmission to be effective. Actually, both these conjectures are true, and it will be necessary to see how they are related.

It is found that the height at which reflection takes place for medium waves is some 60 km. As the wavelength is reduced, the apparent height of the reflecting layer increases to some hundred kilometres for wavelengths of 30 metres or less. This increase is not gradual and indicates two layers, usually denoted as the E and F layers respectively. In Fig. 1 is shown the method of transmitting long and short waves.

Reflected Rays

In considering these layers it must be remembered that they are merely belts of ionised gases, and are not to be compared in their powers of reflection with a good conductor, such as a sheet of metal.

A short-wave transmitter ST is shown communicating with a receiver R under conditions such that only a single-layer reflection is necessary. Three rays are shown emitted by ST, and that of highest elevation is too incident on the layer for complete bending back to earth. The next lowest ray is just within the bending powers of the layer, and after passing inside it is returned to earth at R; while another ray only a little less vertically projected is easily reflected to R. Communication with R in such a condition is bound to be very unreliable, for only a small decrease in the F layer's reflecting powers will result in a complete loss of signals. Such a condition may be found in communication between England and California on 20 metres at about 1500 GMT just before that waveband becomes void of signals.

Much more reliable communication might be obtained by using a longer wavelength, with the ray paths depicted between LT and R. Actually, the single-ray path shown between the E layer and earth is supplemented by innumerable rays capable of reflection, and the path between LT and R is filled with a "trellis-work" pattern of various angles. It is evident that such a condition is, apart from occasional fading, very little affected by variations in the layer, for there are several possible ray paths between the transmitter and receiver on the longer wavelength. The impossibility of realising such an ideal is due to the imperfections of the layer as a reflector. At each reflection attenuation also occurs, and, consequently, after some thousands of miles, the signal is completely lost. It is, therefore, only possible to obtain the longer ranges by the use of short waves reflected by the higher F layer, principally because greater distances are covered in a small number of reflections.

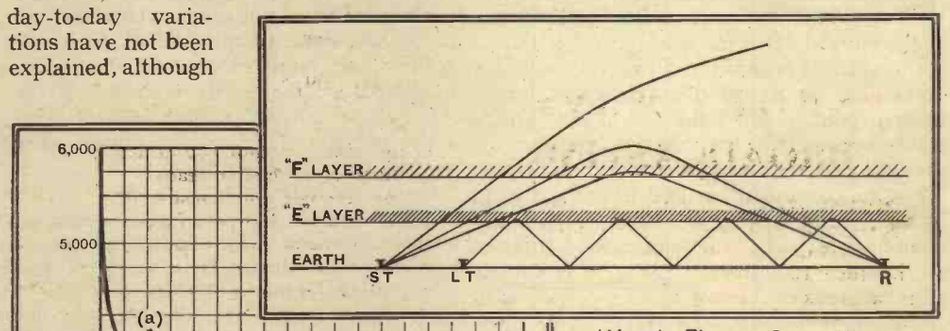
So far, the wide day-to-day variations have not been explained, although the general condition for the longer-distance reception has been indicated. It is seen in Fig. 1 that the short-wave signal passes twice through the E layer at each F layer reflection. In this condition the E layer is not perfectly "transparent," and consequently attenuates without appreciable bending. We have seen that the longer waves, reflected at a height of 60 km., cannot reveal much of the conditions higher in the layer through which the shorter waves pass. It is, therefore, possible to have a large increase in ionisation at higher altitudes and consequent increased short-wave attenuation, without appreciable effect on long-wave conditions.

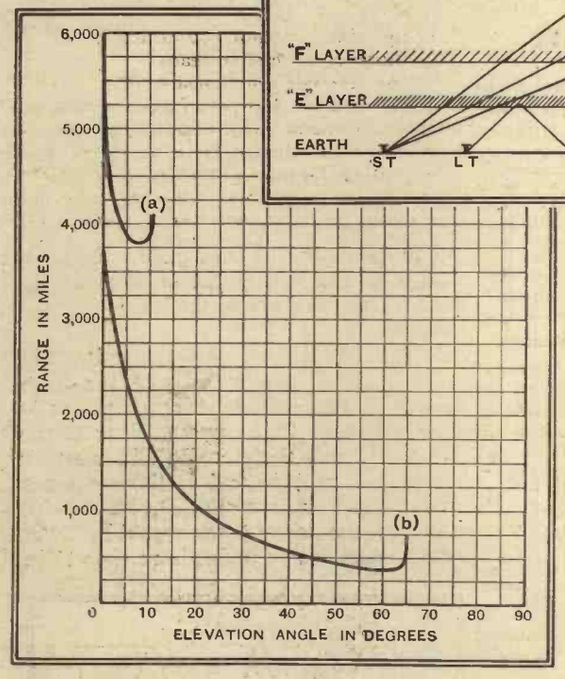
The source of ionisation in the lower layer is the stream of high-speed neutral atoms emitted by the sun. It is a very variable source, and during the passage of a sunspot across the sun may increase a hundredfold, giving, on certain routes, complete wipe-out of short-wave signals due to E layer attenuation.

Low-angle Radiation

Disregarding this E layer effect we are left with the F layer and its simple diurnal variations. Even so, care has been taken in regard to its reflection limitations. At present, wavelengths below 10 metres appear to pass through into space for all angles of incidence, and it is found at night, in winter, even 20 metres is similarly rendered useless. Alternately a full daylight route is workable on 12 to 15 metres, although very little high-angle energy is received. The curves in Fig. 2 indicate these limitations, and show that it is useless to use a transmitting (or receiving) aerial capable of only high-angle ray operation if distant communication is desired. Curve (a) is representative of the shorter wave/night time condition, and curve (b) of longer waves and/or daylight.

The sudden rise in range shown in the curves at the critical elevation angle is accounted for by the second higher-angle ray arriving at R in Fig. 1. This is followed by a sudden increase in range, meaning non-reflection and loss into space.





(Above) Fig. 1.—Long-distance communication depends on reflected waves, and while the lower or "E" layer serves for medium waves a higher "F" layer apparently exists that deflects the short waves.

(Left) Fig. 2.—Aerial systems capable only of high-angle operation confer no advantage in long-distance reception on short waves since little energy is received from these angles. Curve (a) is representative of the shorter wave/night-time condition, while (b) is for longer waves and/or daylight condition.

Short Waves and the Amateur—

It is thus seen that, with care, the short waves are capable of efficient long-range communication, and are complicated by the major attenuation exhibited by the E layer which, under abnormal conditions, is responsible for the variety of results obtained.

DX Notes

Good signals continue to be received at 2300 GMT from South America, PY1AW, PY1DG, LU7EF, and LU9CX being very consistent around midnight on 20m. Signals at this time are all subject to high-speed fading, indicating a very unstable layer condition, and this condition is found earlier on W6HJE and W6AWT when worked at 1615 GMT.

South African signals are good at 1600 to 1800 GMT. After receiving ZU6P at R6 he changed over to 'phone, and this was quite readable in spite of a few deep fades. ZS1H and ZS2J have also been at good strength. It will be noticed that, after the all-daylight route to America has become unusable after nightfall, conditions on 40m. reach their best a few hours later, when attenuation on this wave has been reduced by the slow reduction of E layer ionisation.

SHORT-WAVE BROADCASTING

SHORT-WAVE broadcasting has made possible one of the outstanding transmissions of the year—the B.B.C.'s Christmas Day programme. Yet how many of the millions who listen to that programme have ever had direct contact with the short waves? The percentage must be extraordinarily small.

Short-wave work has made a tremendous appeal during this year to the home-constructor, and its popularity is still increasing by leaps and bounds, but, unfortunately, there still seem to be many who are frightened by the mere mention of it.

Should any such be reading this article, the writer appeals to them to change their ideas and to try to capture for themselves the extraordinary fascination of handling a short-wave set. The chief thrill is the entirely new sensation of receiving stations at tremendous distances with practically the same volume and clarity that one associates with the local stations.

It is a simple matter to increase one's range from one continent to the whole world. Let 1935 be a short-wave "boom" year.

Conditions during the early part of December have been extremely good, with the isolated exceptions of a few days that turned out to be nearly "blank." December 4th was possibly the worst, and very little could be heard of even the more powerful broadcasting stations below 30 metres. December 3rd, on the other hand, was exceptionally good, particularly on the 19- and 16-metre bands.

W3XAL on 16.87, W2XAD on 19.56, W2XE on 19.64 and W8XK on 19.72 metres were all received on the speaker, using *The Wireless World* "1935 AC Short-Wave Receiver."

By the time the 19-metre stations had faded out, the "25's" were coming over at full strength, and they were closely followed by the "31's." So, in fact, do the short-wave broadcast bands follow one another in a long procession on any reasonably good day.

Several new stations are listed on the wavelengths above 50 metres. Many of them look sufficiently interesting to tempt the DX-man, but few have been actually heard in this country as yet.

Worthy of mention are Manila, Philippine Islands (KZGF) on 51.72 metres; Lima, Peru (OA4D) on 51.9 metres; San Jose, Costa Rica (TIX) on 51.92 metres; and Bandoeng, Java (PMY) on 58.3 metres.

At the other end of the short-wave spectrum many new experimental stations have made their appearance. None of them appears to be putting out a regular broadcast, but several of them work with telephony and gramophone records for test purposes.

Just above the 14-metre broadcast band one may hear Buenos Aires (LSL), Rio de Janeiro (PSA), Rugby (GAA), Leopoldsville, Belgian Congo (OPL) and Santiago (CEC), to mention only a few which are well worth trying for.

One or two readers who regularly report transmissions of unusual interest have commented upon an unidentified station transmitting music on about 16.4 metres—just outside the 16-metre broadcast band. The station in question makes no announcement whatever, and switches its carrier-wave off between records. Under these conditions there seems little hope of identifying it! It *might*, however, be Buenos Aires (LSL), which is listed as 16.55 metres.

Readers with receivers that cover the band up to 100 metres may sometimes hear interesting transmissions from American ships on the Naval wavelength of 96.8 metres. Several are reported as working with W2XBJ at Rocky Point.

MEGACYCLE.

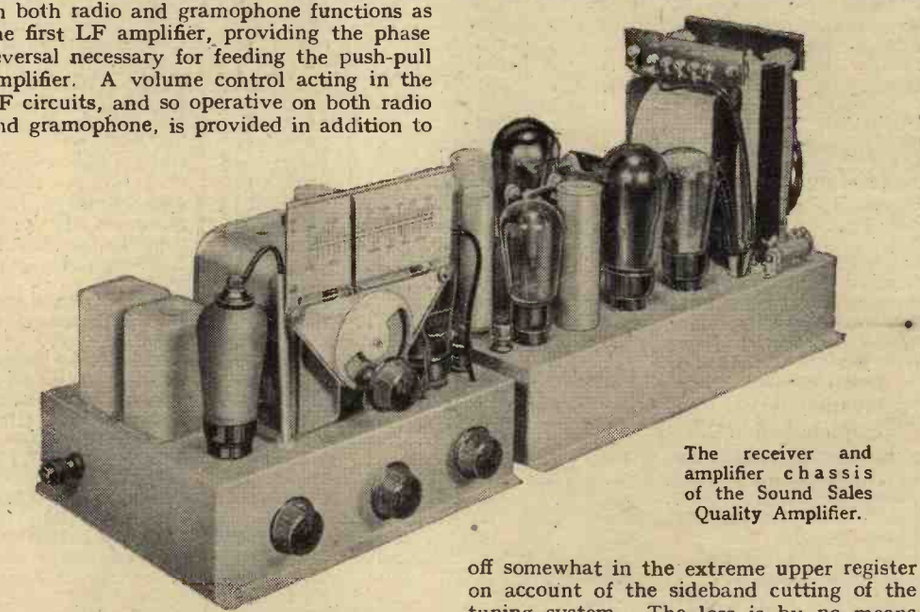
Sound Sales Push-Pull Quality Amplifier

THE Wireless World Push-Pull Quality Amplifier is well suited to act as the nucleus of an ultra-high-quality local station receiver, and the equipment marketed by Sound Sales is based upon it. The apparatus consists of two units—the receiver and the amplifier. The latter is a two-stage double push-pull amplifier with resistance-capacity coupling, and is so arranged that either PX4 or PX25 output valves can be used at will, the necessary circuit changes being readily made by altering the connections of accessible leads.

The receiver unit consists of a single HF stage with a band-pass aerial circuit and a tuned transformer coupling to the duo-diode-triode which acts as the detector, and on both radio and gramophone functions as the first LF amplifier, providing the phase reversal necessary for feeding the push-pull amplifier. A volume control acting in the LF circuits, and so operative on both radio and gramophone, is provided in addition to a control of the grid bias of the HF valve. These two volume controls, together with the waverange switch and tuning control, comprise all the panel controls. The apparatus is assembled on a grey finished metal chassis, and is so solidly constructed that it should give years of trouble-free operation.

The equipment is intended chiefly for high-quality local reception, and it is sufficiently sensitive to provide this in almost any locality with even a poor aerial. When it is used with a good outdoor aerial, however, tests have shown it to be capable of giving good results from a number of foreign stations, and the selectivity is sufficiently high for many of the stronger of such stations to be of entertainment value.

The quality of reproduction on test reached such a high standard that it would be difficult to find any fault with it, the freedom from amplitude distortion being most noticeable. The frequency response is very satisfactory, the loss at 20 c/s and 10,000 c/s being less than 1 db. on gramophone. As one would naturally expect, the fidelity is identical on radio so far as the lower frequencies are concerned, but falls off somewhat in the extreme upper register on account of the sideband cutting of the tuning system. The loss is by no means severe, however, and there is ample output at 10,000 c/s to justify the use of a high-note tweeter, and such a speaker is recommended when the highest quality is required.



The receiver and amplifier chassis of the Sound Sales Quality Amplifier.

The apparatus comprises the receiver and amplifier chassis, a special speaker field replacement choke and valves, and is priced at £25 10s. The makers are Sound Sales, Ltd., Tremlett Grove Works, Junction Road, London, N.19.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(Stations with an aerial power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.
Kaunas (Lithuania)	155	.....	1935	7
Brazov (Romania)	160	.....	1875	20
Huizen (Holland). (*Until* 3.40 *p.m.*)	160	.....	1875	7
Kootwijk (Holland) (*Announced Huizen*). (3.40 *p.m. onwards*)	160	.....	1875	50
Lahti (Finland)	166	.....	1807	40
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	174	.....	1724	500
Paris (Radio Paris) (France)	182	.....	1648	75
Istanbul (Turkey)	187.5	.....	1600	5
Berlin (Deutschlandsender Zeesen) (Germany) (*S.-w. Stns.*, 16.89, 19.73, 25.51, 31.38 *and* 49.83 *m.*)	191	.....	1571	60
Droitwich	200	.....	1500	150
Minsk, RW10 (U.S.S.R.)	208	.....	1442	35
Reykjavik (Iceland)	208	.....	1442	16
Paris (Eiffel Tower) (France)	215	.....	1395	13
Motala (Sweden). (*Relays Stockholm*)	216	.....	1389	30
Novosibirsk, RW76 (U.S.S.R.)	217·5	.....	1379	100
Warsaw, No. 1 (Raszyn) (Poland)	224	.....	1339	120
Ankara (Turkey)	230	.....	1304	7
Luxembourg	230	.....	1304	150
Kharkov, RW20 (U.S.S.R.)	232	.....	1293	20
Kalundborg (Denmark) (*S.-w. Stn.*, 49.5 *m.*)	238	.....	1261	75
Leningrad, RW53 (Kolpino) (U.S.S.R.)	245	.....	1224	100
Tashkent, RW11 (U.S.S.R.)	256.4	.....	1170	25
Oslo (Norway)	260	.....	1154	60
Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)	271	.....	1107	100
Tiflis, RW7 (U.S.S.R.)	280	.....	1071.4	35
Rostov-on-Don, RW12 (U.S.S.R.)	355	.....	845	20
Sverdlovsk, RW5 (U.S.S.R.)	375	.....	800	50
Geneva (Switzerland). (*Relays Sottens*)	401	.....	748	1.3
Moscow, No. 3 (RCZ) (U.S.S.R.)	401	.....	748	100
Voronejs, RW25 (U.S.S.R.)	413.5	.....	726	10
Oulu (Finland)	431	.....	696	2
Ufa, RW22 (U.S.S.R.)	436	.....	688	10
Hamar (Norway) (*Relays Oslo*)	519	.....	578	0.7
Innsbruck (Austria). (*Relays Vienna*)	519	.....	578	0.5
Ljubljana (Yugoslavia)	527	.....	569.3	5
Viipuri (Finland)	527	.....	569.3	13
Bolzano (Italy)	536	.....	559.7	1
Wilno (Poland)	536	.....	559.7	16
Budapest, No. 1 (Hungary)	546	.....	549.5	120
Beromünster (Switzerland)	556	.....	539.6	100
Athlone (Irish Free State)	565	.....	531	60
Palermo (Italy)	565	.....	531	4
Stuttgart (Mühlacker) (Germany)	574	.....	522.6	100
Grenoble, P.T.T. (France)	583	.....	514.6	15
Riga (Latvia)	583	.....	514.6	15
Vienna (Bisamberg) (Austria)	592	.....	506.8	120
Rabat (Radio Maroc) (Morocco)	601	.....	499.2	6.5
Sundsvall (Sweden). (*Relays Stockholm*)	601	.....	499.2	10
Florence (Italy). (*Relays Milan*)	610	.....	491.8	20
Cairo (Abu Zabal) (Egypt)	620	.....	483.9	20
Brussels, No. 1 (Belgium). (*French Programme*)	620	.....	483.9	15
Lisbon (Bacarena) (Portugal)	629	.....	476.9	15
Tröndelag (Norway)	629	.....	476.9	20
Prague, No. 1 (Czechoslovakia)	638	.....	470.2	120
Lyons, P.T.T. (La Doua) (France)	648	.....	463	15
Cologne (Langenberg) (Germany)	658	.....	455.9	100
North Regional (Slaithwaite)	668	.....	449.1	50
Sottens (Radio Suisse Romande) (Switzerland)	677	.....	443.1	25
Belgrade (Yugoslavia)	686	.....	437.3	2.5
Paris, P.T.T. (Ecole Supérieure) (France)	695	.....	431.7	7
Stockholm (Sweden)	704	.....	426.1	55
Rome, No. 1 (Italy) (*S.-w. stn.*, 25.4 *m.*)	713	.....	420.8	50
Kiev, RW9 (U.S.S.R.)	722	.....	415.5	36
Tallinn (Esthonia)	731	.....	410.4	20
Madrid, EAJ2 (Radio España) (Spain)	731	.....	410.4	3
Munich (Germany)	740	.....	405.4	100
Marseilles, P.T.T. (France)	749	.....	400.5	5
Katowice (Poland)	758	.....	395.8	12
Midland Regional (Daventry)	767	.....	391.1	25
Toulouse, P.T.T. (France)	776	.....	386.6	2
Leipzig (Germany)	785	.....	382.2	120
Barcelona, EAJ1 (Spain)	795	.....	377.4	5
Lwow (Poland)	795	.....	377.4	16
Scottish Regional (Falkirk)	804	.....	373.1	50
Milan (Italy)	814	.....	368.6	50
Bucharest (Romania)	823	.....	364.5	12
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832	.....	360.6	100
Berlin (Funkstunde Tegel) (Germany)	841	.....	356.7	100
Bergen (Norway)	850	.....	352.9	1
Sofia (Bulgaria)	850	.....	352.9	1
Valencia (Spain)	850	.....	352.9	1.5
Simferopol, RW52 (U.S.S.R.)	859	.....	349.2	10
Strasbourg, P.T.T. (France)	859	.....	349.2	15
Poznan (Poland)	868	.....	345.6	16
London Regional (Brookmans Park)	877	.....	342.1	50
Graz (Austria). (*Relays Vienna*)	886	.....	338.6	7
Limoges, P.T.T. (France)	895	.....	335.2	0.5
Helsinki (Finland)	895	.....	335.2	10
Hamburg (Germany)	904	.....	331.9	100
Toulouse (Radio Toulouse) (France)	913	.....	328.6	10
Brno (Czechoslovakia)	922	.....	325.4	32
Brussels, No. 2 (Belgium). (*Flemish Prog'mme*)	932	.....	321.9	15
Algiers, P.T.T. (Radio Alger) (Algeria)	941	.....	318.8	12
Göteborg (Sweden). (*Relays Stockholm*)	941	.....	318.8	10
Breslau (Germany)	950	.....	315.8	60
Paris (Poste Parisien) (France)	959	.....	312.8	100
West Regional (Washford Cross)	977	.....	307.1	50
Cracow (Poland)	986	.....	304.3	2
Genoa (Italy). (*Relays Milan*)	986	.....	304.3	10
Hilversum (Holland). (7 *kW.* till 6.40 p.m.)	995	.....	301.5	20
Bratislava (Czechoslovakia)	1004	.....	298.8	13.5
North National (Slaithwaite)	1013	.....	296.2	50
Barcelona, EAJ15 (Radio Asociación) (Spain)	1022	.....	293.5	3
Königsberg (Heilsberg Ermland) (Germany)	1031	.....	291	60
Parede (Radio Club Português) (Portugal)	1031	.....	291	5
Leningrad, No. 2, RW70 (U.S.S.R.)	1040	.....	288.5	10
Scottish National (Falkirk)	1050	.....	285.7	50
Bari (Italy)	1059	.....	283.3	20
Tiraspol, RW57 (U.S.S.R.)	1068	.....	280.9	4
Bordeaux, P.T.T. (Lafayette) (France)	1077	.....	278.6	12
Zagreb (Yugoslavia)	1086	.....	276.2	0.7
Falun (Sweden)	1086	.....	276.2	2
Madrid, EAJ7 (Union Radio) (Spain)	1095	.....	274	7
Madona (Latvia)	1104	.....	271.7	50
Naples (Italy). (*Relays Rome*)	1104	.....	271.7	1.5
Alexandria (Egypt)	1122	.....	267.4	0.25
Belfast	1122	.....	267.4	1
Nyiregyhaza (Hungary)	1122	.....	267.4	6.2
Hörby (Sweden). (*Relays Stockholm*)	1131	.....	265.3	10
Turin, No. 1 (Italy). (*Relays Milan*)	1140	.....	263.2	7
London National (Brookmans Park)	1149	.....	261.1	50
West National (Washford Cross)	1149	.....	261.1	50
Kosice (Czechoslovakia). (*Relays Prague*)	1158	.....	259.1	2.6
Moravska-Ostrava (Czechoslovakia)	1158	.....	259.1	11.2
Monte Ceneri (Switzerland)	1167	.....	257.1	15
Copenhagen (Denmark). (*Relays Kalundborg*)	1176	.....	255.1	10
Kharkov, No. 2, RW4 (U.S.S.R.)	1185	.....	253.2	10
Frankfurt (Germany)	1195	.....	251	17
Prague, No. 2 (Czechoslovakia)	1204	.....	249.2	5
Lille, P.T.T. (France)	1213	.....	247.3	5
Trieste (Italy)	1222	.....	245.5	10
Gleiwitz (Germany). (*Relays Breslau*)	1231	.....	243.7	5
Cork (Irish Free State) (*Relays Athlone*)	1240	.....	241.9	1
Juan-les-Pins (Radio Côte d'Azur) (France)	1249	.....	240.2	2
Rome, No. 3 (Italy)	1258	.....	238.5	1
San Sebastian (Spain)	1258	.....	238.5	3
Nürnberg and Augsburg (Germany) (*Relay Munich*)	1267	.....	236.8	2
Christiansand and Stavanger (Norway)	1276	.....	235.1	0.5
Dresden (Germany) (*Relays Leipzig*)	1285	.....	233.5	1.5
Aberdeen	1285	.....	233.5	1
Austrian Relay Stations	1294	.....	231.8	0.5
Danzig. (*Relays Königsberg*)	1303	.....	230.2	0.5
Swedish Relay Stations	1312	.....	228.7	1.25
Budapest, No. 2 (Hungary)	1321	.....	227.1	0.8
German Relay Stations	1330	.....	225.6	1.5
Montpellier, P.T.T. (France)	1339	.....	224	5
Lodz (Poland)	1339	.....	224	1.7
Dublin (Irish Free State) (*Relays Athlone*)	1348	.....	222.6	1
Milan, No. 2 (Italy) (*Relays Rome*)	1348	.....	222.6	4
Turin, No. 2 (Italy). (*Relays Rome*)	1357	.....	221.1	0.1
Basle and Berne (Switzerland)	1375	.....	218.2	0.5
Warsaw, No. 2 (Poland)	1384	.....	216.8	2
Lyons (Radio Lyons) (France)	1393	.....	215.4	5
Tampere (Finland)	1420	.....	211.3	1.2
Newcastle	1429	.....	209.9	1
Béziers (France)	1429	.....	209.9	2
Paris, (Radio LL) (France)	1429	.....	209.9	2
Miskolc (Hungary)	1438	.....	208.6	1.25
Fécamp (Radio Normandie) (France)	1456	.....	206	10
Pecs (Hungary)	1465	.....	204.7	1.25
Bournemouth	1474	.....	203.5	1
Plymouth	1474	.....	203.5	0.3
International Common Wave	1492	.....	201.1	0.1
International Common Wave	1500	.....	200	0.1
Liepaja (Latvia)	1737	.....	173	0.1

NOTE. Since the publication of the previous list alterations have been made to the particulars of the following stations: Ankara (Turkey), Grenoble P.T.T. (France), Istanbul (Turkey), Sofia (Bulgaria), Warsaw No. 1 (Raszyn) (Poland).

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With discharge indicators

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Type 2NAG9	2 volt	48 a.h.	12/6
Type 2NAG11	2 volt	60 a.h.	14/6
Type 2NAG13	2 volt	72 a.h.	16/6

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This motor is designed primarily for D.C. Circuits but can, if required, be operated on A.C. 40/50-cycle supplies.

• • •

Write for Free Booklet AG. 490.

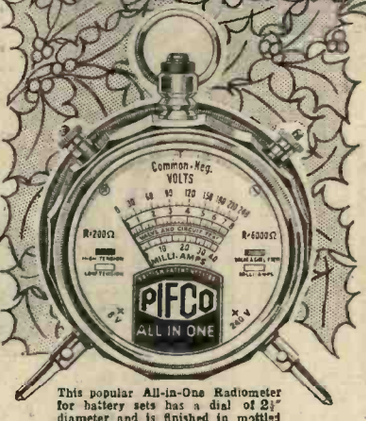
Other models include:—
TRUSPEED-AC. for A.C. circuits price 49/6
UNIVERSAL for A.C. & D.C. circuits „ 99/6
All fitted with automatic stop switches

BTH RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND
A1775 N.

"Now that's a really sensible Xmas present..."

A PIFCO ALL-IN-ONE RADIOMETER!"



This popular All-in-One Radiometer for battery sets has a dial of 2½" diameter and is finished in mottled bakelite. Hundreds of thousands are in use all over the world. A case can be supplied at 2/6 extra.

An inexpensive present yet one which will bring lasting delight to every Radio enthusiast owning a battery receiver.

The Pifco All-in-One Radiometer is unique among testing instruments, enabling a number of useful tests to be made and troubles to be traced in no time.

The happy owner will soon admit that it is one of his most useful and interesting possessions.

See one at your Dealers, or write for the new Testmeter Folder to PIFCO LTD., SHUDEHILL, MANCHESTER, or 150, Charing Cross Road, London, W.C.2.

12/6

PIFCO 'All-in-One' RADIOMETER A.C AND D.C

PIFCO ON THE SPOT WILL TRACE YOUR TROUBLES LIKE A SHOT

MISCELLANEOUS ADVERTISEMENTS

NOTICES.

THE CHARGE FOR ADVERTISEMENTS in these columns is

12 words or less, 3/- and 3d. for every additional word.

Each paragraph is charged separately and name and address must be counted.

SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue: 13 consecutive insertions 5%; 26 consecutive, 10%; 52 consecutive, 15%.

ADVERTISEMENTS for these columns are accepted up to **FIRST POST** on **MONDAY MORNING** (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on **SATURDAY MORNING** at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26B, Renfield Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made & Co. payable to ILIFFE & SONS Ltd., and crossed Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

IMPORTANT NOTICE.

Owing to the Christmas Holidays, the next two issues of "THE WIRELESS WORLD" are closing for press earlier than usual.

In accordance with the Notice that appeared last week, the latest date upon which Miscellaneous Advertisements could be accepted for the issue of December 21st was FRIDAY, December 14th.

For the issue of December 28th advertisements for these columns can be accepted up to FIRST POST THURSDAY, December 20th.

Set Manufacturers' Surplus, Clearance and Bankrupt Stocks offered in any of these columns may not be Manufacturers' current lines. Radio components advertised at below the list price do not carry any manufacturer's guarantee.

RECEIVERS AND AMPLIFIERS, ETC.

PHILIP KAY (Victoria) Christmas Set Bargains:—

£6/19/6.—Craven 5-valve superhet, 200-250-volt, Plessey chassis, Magnavox moving coil, complete with B.V.A. valves, in futuristic walnut cabinet, full 3 watts output, listed £14/14.

£6/6.—Fox Industrial 4-valve superhet, 200-250 D.C., complete with latest H.F. pentodes and Magnavox M.C., in superb walnut cabinet, listed £13/13.

29/6.—S.G.3 battery receiver, 2-gang Polar tub, Ormond L.S., in dark oak cabinet, listed £8/15 (without valves).

CALL and Inspect; over hundred sets to choose from; c.o.d. or c.w.o., carriage forward.

PHILIP KAY, Ltd., L7 Strutton Ground, S.W.1. [7161

H.M.V. 1932 D.C. Radio-Gram, scarcely used, cost 25 guineas.—Box 2445, c/o *The Wireless World*. [7243

£12/5.—Pilot kit "Wireless World" A.C.3, wired; first cash £8/10 secures.—Spillman, 24, Pasley St., Devonport. [7186

"WIRELESS World" Single Span "Battery Kit"; £5/15.—Mallery, 61, Westminster Bridge Rd., London. [7202

MURPHY A8 with stand, in perfect order; £12; seen and tried.—R., 8, Edge Hill, Wimbledon. Wimbledon 5726. [7236

EMERSON, the world's finest superhet. 4-, 5- and 6-valve receivers, long, medium, and short wave, all the latest A.V.C. models, just released, first consignment in this country; also 6-valve car radio; send for catalogue.—Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, E.18. [7153

TECHNICAL TOPICALITIES

A fortnight ago a manufacturer of loud speakers gave a lecture on how to design them.

We beg to differ.

(1) The majority of loud speaker manufacturers use seamless moulded paper diaphragms because they can be "smacked out" by the thousand and at low cost. When one has to turn out a speaker that shall be inexpensive the saving of pence in manufacture is of vital importance. When one has to turn out a speaker that shall, above all else, be possessed of a wide, flat frequency response, then the cost is not so important. We could use moulded paper cones, but, in order to preserve the higher frequencies, we have to use a very expensive material, which is the very devil to handle. The diaphragm of the Hartley-Turner speaker costs, probably, four times as much as that of any other speaker on the market, and we do not use such an expensive cone for "show." We have been trying to find a cheaper one for six years, with the performance our customers expect, but we have not been successful up to the present.

(2) The diameter of the moving coil is arrived at after suitable experiment. We have made experimental speakers identical except for the speech coil, and we have found that the ideal size is ¾in. Unfortunately, this introduces difficulties in manufacture, so we standardised on the smallest practicable size—1in. We didn't care two hoots what the size might be; experiment showed the small coil was most efficient.

(3) The field magnet is only expected to be a magnet. We have sold speakers with cylindrical pots and our present model has an open frame type, because it is lighter, cheaper, more efficent and allows better dissipation of the heat generated in the field coil. However, such a magnet calls for expensive press-tools, not justified on a small production. When we were a small firm, the cost of these tools was prohibitive.

(4) If one likes synthetic bass, then one should definitely choose a "not over-supple surround." It happens to be a fact, however, that the very low notes insist that the diaphragm shall move, and move a lot? The perfect speaker would have complete freedom of suspension of the diaphragm; ours is not perfect, but we believe our surround is the most supple on the market. That is why there is no "boom" with a Hartley-Turner speaker.

Responsible acoustic engineers are very timid at advancing "facts," and the design of loud speakers is still very controversial. We do not claim to be infallible, and some day we may make a better speaker. We have not succeeded yet, and our customers tell us that nobody else has done so. In the meanwhile, we think you had better buy

HARTLEY-TURNER
THE DEBUNKED SPEAKER

Illustrated literature free on request.

HARTLEY TURNER RADIO LTD.,
Thornbury Road, Isleworth, Middlesex.
Telephone: HOUnslow 4488.

NUMBERED ADDRESSES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box ooo, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

DEPOSIT SYSTEM.

Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

Receivers and Amplifiers, Etc.—Contd.

DEGALLIER'S Offer Brand New 1935 Receivers, midgets and otherwise, everyone guaranteed, all carriage paid; I.F.S. extra.

£4/6/3.—Emerson midget, 5-valve, A.C./D.C., 100-250 volts, M.C. speaker, tone control, illuminated dial, M and long wave, P.U. terminals, cabinet 11¼×5½×7.

THE Following, all R.C.A. Victors (H.M.V. in U.S.A.).

£6/10.—Midget 5-valve superhet, A.C./D.C., 100-250 volts, A.V.C., illuminated dial, tone control, M.C. speaker, L. and M. waves, can also be run from batteries, with adaptor included, cabinet 11½×7×5¾.

£7/10.—Midget 6-valve superhet, covering 13-50, 190-550 and 1,000-2,000 metres, guaranteed to get America, P.U. terminals, A.V.C., tone control, illuminated dial, A.C./D.C. 200-250 volts, cabinet 14×16×9½.

£7/10.—Table model 5-valve superhet, 7-stage, A.V.C., tone control, 3 watts undistorted, illuminated air plane dial, 8in. speaker, P.U. terminals, L. and M. waves, will get 80 stations on meg. wave alone, A.C./D.C. 200-250v. or A.C. model 5/- extra, cabinet 14×16×10½.

£9/10.—6-valve table model, 8-stage superhet, fitted as in previous model, but covering 13-50 metres, also guaranteed to get America, A.C./D.C. 200-250v. or A.C. model 5/ extra, cabinet 19×16×10½ (sensitivity one microvolt absolute) 3 watts undistorted.

£15/10.—Table model, 21×11½×17, 6-valve, 8-stage, in 4 wave bands, maximum efficiency over whole wave band coverage, 12-2,000 metres, specification as in two previous models. World's first double intermediate superhet, by means of this revolutionary system it is possible to obtain maximum efficiency on all wave bands, sensitivity guaranteed to be better than ½ microvolt absolute, supplied in A.C. 200-250 only (4 watts undistorted).

DEGALLIER'S, 6, Coryton House, 21, Upper Marylebone St., London, W.1. Museum 7795. Nearest Stations, Oxford Circus, Tottenham Court Rd., Goodge St., Great Portland St. Also 3, 59, 58, 137 buses pass the door. [7230

OUR Kit of Parts for "Wireless World" Quality Amplifier, complete in every detail, including valves; amplifier only, £8/10; feeder unit, 36/-.

OUR Kit of Parts for "Wireless World" Olympic 8.S. Six, complete in every detail, including valves and loud-speaker; £14/10.

OUR Kit of Parts for "Wireless World" Standard A.C.3, complete with valves and speaker; £11/10.

SEND for Detailed List of Components for Either of the Above Kits; carriage paid, cash with order.

WARD, 46, Farringdon St., London, E.C.4. 'Phone: Holborn 9703. [6907

KOLSTER-BRANDES Amplifier, all mains, 14 watts, undistorted, push-pull output, built-in speaker, including valves; £10.—Herrington, 54, New St., Ashford, Kent. [7187

1935 Manufacturer's Stock, 4-valve A.C. Band-pass receivers, walnut cabinets, Mazda valves, Rola speakers; £5/10; approval against cash.—Mande, 1, Martin St., Brighouse. [7116

£4/10.—Special offer!! Regentone Class B 4-valve, handsome square-fret walnut cabinet, Rola M.C. Straight-line Lucerne scale, complete B.V.A. valves; ditto 4-valve superhets., £5/10; chassis, Class B, 30/-; B.P.A, 25/-.—Coy, 23, Filmer Rd., Fulham, S.W.6. [7217

"Radio Data Charts," A Series of Abacs Post free 4/10

Receivers and Amplifiers, Etc.—Contd.

£4/10 Each.--(3 only) Eelex M2 super model short wave converters, A.C. model, 15-115 metres, walnut cabinet, full instruction; listed £8/15.—Degallier's, 21, Upper Marylebone St., London, W.1. Museum 7795. [7231

7-VALVE Superhet, Alba chassis (by Plessey), made for a well-known proprietary firm whose name we are not allowed to mention, 7 tuned stages, delayed A.V.C., local distance switch, 7-kc. separation, Mullard valves, A.C. 200-250 volts, demonstration daily at 94, High Holborn, chassis complete with Mullard valves, brand new, less speaker and cabinet; £7/10.—Radio Clearance, 94, High Holborn, W.C.1. [7242

FIRST Consignment of Emerson 1935 "Round the World" 6-valve Superheterodyne, 19-2,000 metres, 3 separate wavebands, acclaimed by trade as the best all-wave receiver yet produced, aeroplane dial tuning, "Duo-Lite" band switching, dynamic speaker, automatic volume control, gramophone pick-up, walnut cabinet 16¾in. high, 13¼in. wide.—Write for wholesale catalogue to Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, London, E.18. [7016

£6/18/6.—5 valve superhet. chassis (7-stage), complete with B.R.V.M.A. valves, wired, brand new, ready to switch on; speaker the only extra required; 9 kc. separation; A.V.C. all-British throughout; components by world-famous manufacturers, Polar, T.C.C., Wearite, etc.; 12 months' guarantee; ideal for fitting to existing cabinet, bookcase, etc; have a really up-to-date set for Xmas; A.C. model, £6/18/6; Universal, £7/7; immediate delivery, carriage paid, 7 days' approval, deferred terms if desired; fullest particulars on request.—Westminster Chassis Co., Ltd., 4, Westminster Palace Gardens, London, S.W.1. [7183

ARMSTRONG.—Latest 5v. bandpass superheterodyne chassis, with fully delayed A.V.C., 7 highly efficient tuned circuits, bandpass input, Marconi Heptode frequency changer, combined 1st detector and oscillator, bandpass I.F. coupled to Marconi H.F. pentode, bandpass coupled to Cossor Double Diode, giving distortionless detection and A.V.C., resistance coupled to Mazda high slope pentode, Marconi bi-phase rectifier, full vision illuminated tuning, calibrated in wavelengths, combined radio and gramophone volume control, corrected pentode output, giving exceptionally good reproduction; £6/18/6, with valves, royalties paid.

ARMSTRONG.—5-valve 8-stage superheterodyne chassis, with fully delayed A.V.C., bandpass input, Mullard Octode frequency changer, combined oscillator and first detector, bandpass I.F. coupled to Mullard screened pentode, coupled to Mullard Double Diode Triode, resistance capacity coupled to Mullard 3 watts output pentode, Mullard indirectly heated rectifier, combined radio-gramophone volume control, full aperture drive, calibrated wavelengths. —Massively constructed with the following components. Wearite heavy duty mains transformer, Wearite special coils and I.F. transformers, Polar ganged condenser and drive, Wearite switching, Hellesen condensers, etc., etc.; price complete, £7/10; this chassis is designed for those requiring slightly more output, particularly on gramophone than our 5v. 7-stage chassis, but it does not supersede this very popular model.

ARMSTRONG.—4v. 3 Pentode radiogram chassis, full bandpass; £5/18/6, with valves.

ARMSTRONG.—4v. Universal radiogram chassis, full bandpass; £5/18/6.

ARMSTRONG Chassis, use highest grade components throughout, are sent 7 days' approval, carriage paid, guaranteed one year.

ARMSTRONG MANUFACTURING Co., 100, King's Rd., Camden Town, London. 'Phone: Gulliver 3105. [7208

MAINS EQUIPMENT.

PARAMOUNT Mains Transformers Lead in Price and Quality.

PARAMOUNT Transformers are Suitable for all "W.W." Circuits.

PARAMOUNT Transformers Guaranteed for 2 Years, and the best British materials, 2½ mils. thick insulating paper between each layer, with standard primaries, 200-250v. 50 cycles, all secondaries C.T.

PARAMOUNT 250-0-250v. 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., open type, 9/-; shrouded, 11/-; post 9d.

PARAMOUNT Ferrocart III. 350-0-350v. 75 m.a., 4v. 2-5a., 4v. 3 to 5a., open type, 12/-; shrouded, 14/-; post 9d.

PARAMOUNT Transformers Made to Your Own Specification; price according to wattage; quotations by return.

PARAMOUNT 350-0-350v. 120 m.a., 4v. 2.5a., 4v. 4a., 4v. 5a., open type, 14/-; shrouded, 15/6; post 1/-.

WE are Proud of our 5-valve Super Inductance Receiver; write for details; price £9, complete in walnut cabinet.

PARAMOUNT 400v., 450v. or 500v. 120 m.a., 4v. 2.5a., 4v. 4a., 4v. 5a., open type 17/, shrouded 19/-, post 1/3; 150 m.a. with 2 extra filaments (not exceeding wattage), open type 22/6, shrouded 25/-, post 1/3.

PARAMOUNT Super Models.—H.T.8, 9 or 10, 4v. 1 to 2a., 4v. 2 to 4a., open type, 14/-; shrouded, 15/6; post 1/-; don't pay high prices for your mains components.

PARAMOUNT Auto Transformers, 100-120v. to 200-250v. or vice versa, 60-watt, 8/-; 120-watt, 9/6; shrouded, 1/- extra; post 9d.

PARAMOUNT Mains Chokes, 30 h. 60 m.a., 5/6; 20h. 120 m.a., 8/-; post 9d.

PARAMOUNT Guaranteed Electrolytic Condensers, 4+4 mfd., 500 peak; price 3/6; post 3d.

PARAMOUNT Mains Transformers Manufactured by R. H. Salter, 66, Hartfield Rd., Wimbledon, S.W.19. Tel.: Liberty 3226. [6929

BATTERY Chargers.—The "N.P." (late Nash Products) have the lowest prices yet still maintain quality; trade lists free.

BATTERY Chargers.—" N.P." from 50/- to £15; charging plants of highest quality.—N.P. Electric Co., 514, Alum Rock Rd., Birmingham. [7152

PILOT AUTHOR KITS
Exact to Specification

NEW SINGLE SPAN
• BATTERY FOUR •

KIT "A" CASH OR C.O.D. CARRIAGE PAID. £6 - 12 - 6
or 12 monthly payments of 12/3.
KIT "A" Author's Kit of first specified parts, including ready drilled Plymax baseboard and polished Plywood Panel, less valves, cabinet and speaker.

KIT "B" As for Kit "A" but including set of 4 specified valves, less cabinet and speaker. Cash or C.O.D. Carriage paid. £9 15 0. Or 12 monthly payments of 17/9.

KIT "C" As for Kit "A" but including valves and Peto-Scott cabinet, less speaker. Cash or C.O.D. Carriage Paid .. .. £11 10 0 Or 12 monthly payments of 21/-.

KIT-BITS You pay the Postman. We pay post charges on all orders over 10/-. GREAT BRITAIN ONLY.

1 Peto-Scott ready-drilled Plymax Chassis 9"×14"×2½"	7s. 0d.
1 Peto-Scott ready-drilled polished Plywood Panel 14"×10½"	2s. 0d.
1 Wearite set of 4 Coils	7s. 6d.
1 Wearite Aerial Filter	13s. 6d.
1 Eddystone 973 Tuning Dial	10s. 6d.
1 set of 4 Specified Valves	£3 2s. 6d.

SINGLE SPAN BATTERY FOUR CABINETS

C.A.C. Cabinet, as specified	£1 18s. 0d.
PETO-SCOTT Cabinet, built by Peto-Scott's Expert Craftsmen. In handsome figured Walnut	£1 15s. 0d.

Carriage 2/6 extra on either cabinet.

EXPORT ORDERS Simply send full cash value plus a suitable amount for half carriage charges and any surplus will be immediately refunded. Packed free, we pay half carriage. Air Mail charges extra. PETO-SCOTT, established in 1919, are the largest Radio-by-Mail House in the World. Hire-purchase terms are NOT available to Irish or Overseas Customers.

PETO-SCOTT CO. LTD.
77 CITY RD., LONDON, E.C.1 'Phone: Clerkenwell 9406/7
West End Showrooms: 62, High Holborn, London, W.C.1
Est. 1919.

There was a young fellow named Sid
Always practical in all that he did;
His hobby was Wireless—
At it he was tireless—
And using FLUXITE—
saved many a quid!

See that Fluxite is always by you—in the house—garage—workshop—anywhere where simple, speedy soldering is needed. Used for 30 years in Government works and by the leading engineers and manufacturers. Of all Ironmongers—In Tins 4d., 8d., 1/4 and 2/8.

Ask to see the Fluxite Small-space Soldering Set—compact but substantial—complete with full instructions—7/6. Ask also for Leaflet on Case Hardening Steel and Tempering Tools with Fluxite.

THE FLUXITE GUN
is a handy and economical tool that enables you to put the Fluxite where you want it on the soldering job, and is clean and simple to use. Nothing to remove — no mess — no trouble. Always READY FOR USE.

Also used to project grease into grease cups, bearings, etc.

Just fill the nozzle portion—half fill the cup—put together and press as required. PRICE 1/6.

ALL MECHANICS WILL HAVE
FLUXITE
IT SIMPLIFIES ALL SOLDERING

FLUXITE LTD. (Dept. W.W.), DRAGON WORKS, BERMONDSEY STREET, S.E.1.

Mains Equipment.—Contd.

V.

VORTEXION Specified.

STANDARD A.C.3 Transformer, polished die cast, shrouding guaranteed 5 years; £1; chassis 6/-, choke to match, 12/6.

STANDARD A.C.2 Transformer, 18/-; choke to match 10/6; 5 years' guarantee.

VORTEXION Specified Olympic S.S. 6 Transformer, S.S.352, 5 years' guarantee, 25/-; less terminals and guarantee, 21/-; power chassis, £3/17/6; choke, 12/6; Single Span model, 25/-; power chassis, £3/10.

WHY Not Call and Inspect Complimentary Letters from Customers Who Have Used Them for Many Years?

VORTEXION.—Quality Amplifier or Super Monodial, 425-0-425, 120 m.a., 4v. 6-8a. C.T., 4v. 3a. C.T., 4v. 1a., 4v. 1a., super shrouded, core size 2¼in.×1½in., 2½% regulation primary engraved insulated terminals, weight 14lb., 26/-, carriage 2/-; normal shrouded, 22/-; open type, 20/-, post 1/3; speaker field replacement choke, 16/-; special output transformer to "W.W." specification, 12/6, post 9d.; state valve and speaker; "W.W." universal output transformer, £1; normal 40h. 50 m.a. primary output transformers, 10/6, post 9d.

VORTEXION 7.30h. 120 m.a. Choke 215 ohms in die cast shrouding to match; 12/6.

IMITATED but unequalled. Good enough for a "Wireless World" specification is good enough for you.

VORTEXION Cost Little More than the Cheapest, but unequalled by the dearest.

VORTEXION A.C./34, used by author in construction of A.V.C. Three, as illustrated; 18/-.

GUARANTEED 12 Months, and within 5% normal and 2½% super models, neat shrouding, with detachable feet, as used by Government Departments, etc., etc., any model guaranteed 5 years at extra cost of 2/-.

ALL Secondaries Centre Tapped.

VORTEXION.—250-0-250 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., open type, 10/-; shrouded, 12/6; post 9d.

VORTEXION.—Ferrocart III 350-0-350, 60 m.a., 4v. 2.5 C.T., 4v. 3.5 C.T.; open type 13/6, shrouded 16/-; post 9d.

VORTEXION Super Model for H.T.8 or 9 or 10, 4v. 1 to 2, 4v. 2 to 4, open type 14/6, shrouded 16/6; post 1/-.

VORTEXION.—350-0-350, 120 m.a., 4v. 2 to 5a., 4v. 2 to 4a., 4v. 2.5a.; open type 14/6, shrouded 16/6; super shrouded model, weight 11lb., 4 filaments to specification, 21/-; post 1/3.

VORTEXION.—400 or 450 or 500v., 120 m.a., 4v. 2 to 5, 4v. 2 to 5, 4v. 2.5a.; open type 19/-, shrouded 23/-.

VORTEXION.—400 or 450 or 500, 150 m.a., 4v. 4a., 4v. 2.5, 4v. 2, 4v. 2, 4v. 2, core size 2¼×1in., a super job 2% regulation 35/-, shrouded, with terminals; less terminals, 30/-; open type, 26/-; post 1/3.

VORTEXION Auto Transformers to B.E.S.A. Specification, 100, 110, or 120. to 200, 220, or 240 volts, 60 watts, 9/-; post 9d.; 120 watts, shrouded 12/6, open type 10/6, post 1/-; 200 watts, shrouded 16/6, post 1/-; 2,000 watts, £4/10.

VORTEXION 1,000-watt Transformers; £4/10, carriage free.

VORTEXION 30h. at 60 m.a., Chokes, 5/6; 40h. at 60 m.a., 8/6; 30h. at 150 m.a., 200 ohms, 10/6 open type, 12/6 shrouded.

VORTEXION Transformers Made to Your Specification; price according to wattage, 6v. filaments same price unless wattage grossly exceeded; special quotations by return.

VORTEXION (S. A. BROWN), 182, The Broadway; works, Stanley Rd., Wimbledon, S.W.19. Tel.: Liberty 2814. [7225

HOYNE'S Transformers are Manufactured by Engineers with 14 Years' Experience in Radio Transformer Design.

HOYNE'S.—The acknowledged finest value in transformers and chokes.

HOYNE'S.—Used exclusively by many established set manufacturers, relay stations, transmitters, and Government Departments.

HOYNE'S.—Section wound, paper interleaved, filaments, centre tapped, aluminium clamps and terminal strips to all models.

HOYNE'S.—Specified by "Wireless World," and wound strictly to the specification of the author.

HOYNE'S.—Standard A.C.2 transformer, 300-0-300v., 60 m.a., 4v. 2.5a., 4v. 2a., price 12/6, post 1/-; 20h. 75 m.a. choke, 8/6, post 9d.

HOYNE'S.—Standard A.C.3 and Ferrocart III transformer, 350-0-350v., 60-70 m.a., 4v. 2.5a., 4v. 4a.; price 12/6, post 1/-.

HOYNE'S.—Push-pull Quality Amplifier transformer, 25/-, post 1/3; 7/30 henrys choke, 9/6, post 9d.; 20 henrys, 7/6. post 9d.

HOYNE'S.—Single Span. 15/-, post 1/-; choke, 10 henrys, 7/6, post 9d.

HOYNE'S.—Everyman A.C. super transformer. 12/6, post 1/-; choke, 10 henrys, 7/6, post 9d.

HOYNE'S.—A.V.C. Straight Four transformer, 18/-, post 1/3; choke, 26 henrys, 120 m.a., 140 ohms. 9/6, post 9d.

HOYNE'S.—250-0-250v. 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., 10/-, post 9d.; with extra 4v. 1 to 2a. winding, 12/6, post 1/-.

HOYNE'S.—Ferrocart III. 350-0-350v., 60-70 m.a., 4v. 2 to 3a., 4v. 2 to 4a., 12/6, post 1/-; with extra 4v. 1 to 2a. winding, 13/6, post 1/-.

HOYNE'S.—350-0-350v., 120 m.a., 4v. 2 to 3a., 4v. 4 to 6a., 4v. 1a., 4v. 1a., 18/-, post 1/3.

HOYNE'S.—400 or 450 or 500v., 120 m.a., 4v. 2 to 3a., 4v. 2 to 5a., 4v. 1 to 2a., 18/-, post 1/3.

HOYNE'S.—500-450-0-450-500v. 140 m.a., 4v. 2 to 4a., 4v. 4 to 6a., 4v. 2a., 4v. 2a., 27/6, post 1/3; weight 11lb.

HOYNE'S Transformers, built to specifications, keenest prices, best materials and workmanship; quotation by return.

HOYNE'S.—All advertised types from stock.

HOYNE'S.—Open from 9 a.m. till 7 p.m., including Saturday.

M. J. HOYNE, ALL-POWER TRANSFORMER, Ltd., Offices and Works, 8a, Gladstone Rd., Wimbledon, S.W.19. Tel.: Liberty 3303. [7068

Mains Equipment.—Contd.

TANTALUM for A.C. Chargers, H.T. and L.T.—Blackwell's Metallurgical Works, Ltd., Garston, Liverpool. [6470

14/11.—Battery chargers, 1 amp., 2-6v., incorporating Westinghouse rectifier, ½ amp.; 10/-; 7 days' cash approval; postage 9d.; list free

22/-.—Arden eliminators, 20 m.a.; test before purchasing; particulars free.—Arden Agency, Wollaston, Wellingborough. [7131

CABINETS.

MANUFACTURERS' Clearance.

SET and Speaker Cabinets; 5/- upwards.

S.T.600, dark walnut finish, for set and speaker, undrilled; 21/-.

RADIOGRAM Cabinets; 37/6 upwards.

SPEAKER Cabinets; 4/6 upwards.

SEND Particulars of Your Requirements (giving size of set, etc.), or call and make your choice from our stocks of over 100 different types; from 3/6 to £4/10.

MOTORS for Radiograms or Gramophones, clockwork or electric: from 5/-, list on application.

H. L. SMITH and Co., Ltd., 287-9, Edgware Rd., London, W.2. Tel.: Padd. 5891. [7130

DYNAMOS, ETC.

NEW Crypto V.R.3 Charger; £8/10.—Hamilton, 53, Morgan Road, Bromley, Kent. [7215

ELECTRO-DYNAMIC 90 Watt D.C.-A.C. Converter, in sound proof case, new, list £14, accept half.—Augustine Garage, Horsemarket, Northampton. [7182

7 Only.—Rotary convertors, brand new, with smoothing pack, in metal cases, d.c. input 220 volts, a.c. output 220 volts, 90 watts, carriage paid; £2/19/6.—Henry, 60, Hockley Hill, Birmingham. [7180

ROTARY Converters, brand new, in sealed crates (Waite's "standard batteries"), D.C. input 220 volts, A.C. output 230 volts at 90 Watts; at £3/10; carriage forward goods.—Degallier's, 21, Upper Marylebone St., London, W.1. Museum 7795. [7229

GRAMOPHONES, PICK-UPS, RECORDERS.

PROFESSIONAL Wax Recording Machine Waxes, etc., genuine snip; £10, no offers.—Box 2443, c/o *The Wireless World*. [7235

GARRARD Double Spring Motor, turntable, tone arm, sound box, hardly used; 10/6.—Jarvis, 68, Northumberland St., E.14. [7245

LOUD-SPEAKERS.

MAGNAVOX 66 A.C. Model, new; 110/-.—Smith, 20a, Lower Stone St., Maidstone. [7188

ROTHERMEL, Piezo-electric, 55/-; R.95, 25/-, perfect.—Hart, 27, Bishop's Park Rd., S.W.16. [7185

EPOCH Domino Speaker, 6v. field, spare diaphragm, as new; 55/-.—Fair, 158, Kingston Rd., Staines. [7210

ROTHERMEL Piezo Speaker, R.95, new; 32/6.—Dougharty, 68, Woodbourne Av., Streatham S.w.16. [7204

HULBERT, 6, Conduit St., W.1.—Read below: If you are requiring realistic reproduction at remarkably low cost, send for one of the following high-grade speakers; repeat orders are coming in daily.

10/6 Only!!—Brand new manufacturers' surplus moving coil speakers, made by one of the best known British maker; energised. 2,500 or 6,500 ohms field, power or pentode transformer, 8in. cone; 10/6 each.

12/6 Only!!—As above but with 10in. cone, a very powerful speaker capable of handling large outputs.

15/6 Only!!—Brand new manufacturers' surplus moving coil speakers, made by one of the best known British makers; permanent magnet model of high efficiency, with power or pentode transformer, 8in. cone; 15/6 each.

17/6 Only!!—As above but with 10in. cone; ideal for use with quality receivers.

19/6!—Permanent magnet speakers with high efficiency Alni magnets, 8in. cone; 19/6.

24/-!—As above, but with 10in. cone; 24/-.

2/9 Only!!—Brand new cabinets, suitable for any of above speakers; 2/9 each only; secure one of these amazing speaker bargains now; repeat orders are coming in daily; cash with order, or c.o.d.—Hulbert, 6, Conduit St., W.1. [7077

MAGNAVOX D.C.152 (9in. cone), 22/6; Magnavox 154 (6¼in. cone). 16/3; all with humbucking coils, power or pentode transformers, and 2,500- or 6,500-ohm fields; Magnavox P.M.254, 18/-; Magnavox P.M.252, 22/6.

ATTENTION to All Orders Within 24 Hours; carriage paid; cash with order or c.o.d. Send for list.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [6404

MOUNTGROVE SUPPLIES for Quality Speakers; reputable manufacturers' surplus; genuine Alni (nickel-aluminium) P.M.s, all brand new and finished black and chromium, 8in. model, flux density, 7,500 lines in gap, 25/-; 10in. auditorium model, 50,000 line magnet, 20 ratio transformer, response 40-10,000 c.p.s, 78/6; exponential horns, 30×22×22in., to fit 7 or 8in. speaker, 15/6; 7 days' approval against cash or c.o.d., carr. paid.—76, Mountgrove Rd., N.5 (off Blackstock Rd., near Arsenal football ground). Canonbury 2951. [7209

Do You Know That You Can Install a ROLA EXTENSION SPEAKER in a Few Minutes?

It is essential that the Speech Coil impedance and general characteristics of the Extension Speaker match the speaker in the factory-made receiver. **ROLA SUPPLY THE LARGE MAJORITY OF RADIO MANUFACTURERS SO THAT THERE IS A ROLA SPEAKER EXACTLY SUITABLE TO YOUR NEEDS.** *Any attempt to utilise a speaker with a large number of transformer tappings may result in poor quality reproduction both in the receiver as well as the extension speaker.* **THE REASON IS, OF COURSE, THAT BY THIS PROCEDURE ONLY A PORTION OF THE OUTPUT TRANSFORMER IS BEING USED ON ALL TAPPINGS.**

ROLA DUST-PROOF CONSTRUCTION

New Dust-Proof Filter Assembly, radically new Spider Construction and Domed Centre Cap in Apex of Cone, are features of the Rola FR6-P.M. and F6-F.E. models which set new standards in maintained performance supremacy.

IMMEDIATE DELIVERIES NOW AVAILABLE

EXTENSION SPEAKER MODELS (100% Dust-proof Construction)

Model FR6-P.M.M. without transformer **32/-**
Model FR6-P.M. with transformer as per our Extension Speaker Broadsheet..... **39/6**

CABINET MODELS

Model 1. Complete with FR6-P.M. Speaker with transformer as per our Extension Speaker Broadsheet..... **£3.10.0**
Model 2. Complete with FR6-P.M.M. Speaker (without transformer)..... **£3. 2.6**
CABINET alone (with Celotex sounding board attached) **£1.10.0**

JUST PUBLISHED

Your dealer has a copy of the Rola Extension Speaker Show Card giving the correct Rola Extension Speaker for *your* factory-made receiver. Ask to see it or alternatively write direct to Rola (Dept. W.W.) for the Extension Speaker Broadsheet just published.

ROLA
the World's Finest Reproducers

THE BRITISH ROLA CO., LTD.
MINERVA ROAD, PARK ROYAL, N.W.10
'Phone: Willesden 4322-3-4-5-6

Loud-Speakers.—Contd.

VAUXHALL.—Magnavox permanent magnets, universal, suitable for Class "B," power or pentode, 7in. cone 16/6, 10in. cone 23/-; mains energised, 2,500 or 6,500, 10in. cone, 22/-; 7in. cone, 15/3; brand new, with humbucking coils; state power or pentode transformer; unused manufacturers' stock; immediate delivery, carriage paid, cash with order or c.o.d.—Vauxhall Utilities, 163a, Strand, W.C.2. Temple Bar 9338. [7163

TELEVISION.

UTILITY SALES Offers Television with Guaranteed Results. Join us as experimenter. Complete kit of parts, universal mains, instructions to assemble in one hour, motor, lamp, lens, discs, etc.; everything is there; write for list W.W.T.; £3/12/6.

UTILITY SALES, Færitone Corner, 57, Praed St., London. Paddington 0251. [7222

PLEW TELEVISION, Ltd. (in Liquidation).—Having purchased the entire stock of the above, we are offering same under manufacturer's cost; chassis, complete with 4 valves, 59/6; cabinets, 7/6; lenses, 5/6 pair; motors, 10/-; mains leads, with plug adapter, 1/-; etc.; send stamped addressed envelope for full list.—H. L. Smith and Co., Ltd., 289, Edgware Rd., W.2. [7199

VALVES.

AMERICAN Valves, first grade in all types, all Majestic valves; trade supplied.—Metropolitan Radio Service Co., 1,021, Finchley Rd., N.W.11. Speedwell 3000. [0436

AMERICAN Valves!—Brand new R.C.A. and Raytheon, 224s, 235s, 551s, 247s, 9/9; 227s, 245s, 280s, 6/9; and most other types; cash or c.o.d.—Norman Michel, 51, St. Matthew's Parade, Northampton. [7218

SURPLUS Valves.—All brand new; battery types, 2-volt, H.F.2, L.F.2, L.P.2, 1/9; super power, P.P.2, 2/6; screens and pentodes, 3/9; A.C. mains, 4-volt 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid; cash with order, or c.o.d. over 10/-.—Clarion Radio Valve Co., 885, Tyburn Rd., Erdington, Birmingham. [8339

ALL Types of Brand New American Valves in Stock, only first-class makes such as Arcturus and R.C.A. stocked, guaranteed for 6 months, 247, 235, 551, 89, 18, 19, 46, 59, 6A7, 15, 42, 41, 38, 39, 78, 75, 57, 58, 224, 44, 36, 235, 83, 43, 5Z3, 12/-; 25Z5, 12Z3, 14/6; UX171, UX 199, UX280, UX245, UX226, UX227, 7/6; UX250, UX210, UX231, 17/6; UX 867 photocells, 25/-; all other types of American valves in stock; we also stock transmitting valves, post paid, cash with order or c.o.d.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [6517

COMPONENTS, ETC., FOR SALE.

R.

RYALL'S RADIO, 44, Lamb's Conduit St., London, W.C.1. Callers note: we are just off Theobald's Rd., best approach from Holborn through Red Lion St. Holborn 3529. Hours 11 to 7 p.m., Saturdays 5 p.m., Thursdays 1 o'clock.

PAIR Varley P.P. Transformers, 22/6; Bulgin 20H. choke, 4/-; new type Varley Hypermu, unused, 9/-; R.I. parafeed unit, second-hand, 6/6; Varley double ratio output transformer, 5/9; British Radiophone, 2H.F. pack, 30/-.

SET Varley Air Coils, 2H.F., three on base, 17/6; Varley B.P.22 oscillator coils, 3/-; Eckersley tuner, 5/-; Ekco A.C. eliminator, 10/20 type, unused, 30/-; Nicore A.V.C. unit, new, 9/-; Whiteley Boneham 42/- model Microlode speaker, 25/-.

MARCONI K.17 Pick-up, 22/6; Lissen needle armature, 9/-; Burndept needle armature, bronze, 15/-, all with arms; Gambrell Novotono Junior, for medium resistance, P.U., 15/-; Heaybord transformer for H.T.10 with L.T., with H.T.10, 27/6 pair.

J.B. Nugang Three, superhet. type, with disc drive, 12/6; Polar Minor 3-gang, with moving scale drive, 12/6; Polar Star 3-gang super, with D.D., 12/6; Radiophone 3-gang superhet. piano type midget or standard, new, 10/9; all 0.0005.

PAIRS Coupled Radiophone Pots, 5,000 and 50,000, new, 5/-; Bulgin tapped shrouded resistance, for D.C. ¼ amp. valves, 7/6; Lewcos super 60 coils, 4/-; oscillators, 6/-; set 3 Telsen canned coils, B.P. and H.F., 10/-, less switch rod.

BRITISH Radiophone R.F. Superhet. Pack, 110 kc., all fittings, 35/-; 3 ditto intermediates, with terminals, 6/- each; R.I. Dux chokes, second-hand, 5/-; ditto 7-1 G.P. transformer, second-hand, 5/9.

TELSEN Electric Power Pentode Chokes, new, 4/9; Telsen Electric, 15H. power chokes, new, 4/9; Marconi 75-1 shrouded microphone transformer, 5/9; ditto 25-1 output, 5/9; ditto, unshrouded, 3/9.

CHALLIS 500-0-500 Transformer, with 3 L.T. windings for W.W. amplifier, 20/-; Partridge 400-400v. 90 m.a. three L.T.s, 10/-; R.I. L.T. choke, shrouded, second-hand, 5/9; unshrouded type, 3/9; Polar tub 3-gang and drive, 5/9.

J.B. R.I. Single, with D.D., 3/9; Multitone 8-1 Q.P.P. transformer, with graded pot, 12/-; Multitone Puchoke, 5/-; Utility 3-gang, with D.D., 6/6; Ferranti Band Pass tuner kit, 32/6; Sifam 0-100 m.a. meter, m.c. flush, 10/-.

POLAR Minor 4-gang, new, 15/-; Epoch 99 speaker for 200-250v. D.C., been refurbished by makers, 30/-; Epoch 99 P.M., perfect, with Epoch universal transformer, 0-50 and P.P., 35/-.

FERRANTI A.F.5, 16/9; A.F.7, 16/9; A.F.4, 7/6; O.P.M.1, 10/-; O.P.M.17c, 8/6; O.P.M.12c, 7/9; O.P.3c 1-1 P.P., 5/9; O.P.c 2-1 P.P., 3/9; A.F.10, 3/6.

FERRANTI Meters, 0-¾ amp., 20/-; 0-7.5v. D.C., 15/-; 0-250v. 1,000 O.P.V., 35/-; flush moving coil; Hunts flush moving coil, 13/6, 0.20 m.a.; Turner 0-100 m.a., flush, m/c, 15/-.

SEE Last Week's and Next Week's issue for Details of Rest of Goods Available.

R. [7221

Components, Etc., for Sale.—Contd.

PREMIER SUPPLY STORES

ANNOUNCE a City Branch at 165 and 165a, Fleet St., E.C. (next door to Anderton's Hotel) for the convenience of callers; post orders and callers to High St., Clapham.

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra; I.F.S. and abroad, carriage extra; orders under 5/- cannot be sent c.o.d.; please send for illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v. 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker; £12/10.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagrams, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amp., C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps., C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps., 25 hys., 4/-; 65 milliamps., 30 hys., 5/6; 150 milliamps., 30 hys, 10/6; 60 milliamps., 80 hys., 2,500 ohms, 5/6; 25 milliamps., 20 hys., 2/9; 250 milliamps., 30 hys., 20/-.

ALL Premier Guaranteed Mains Transformers Have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; with Westinghouse rectifier, giving 200v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v. 60 m.a. and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a., and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Mains Transformers, output 350-0-350v. 130 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt; 10/-.

WESTERN Electric Mains Transformers, 300-0-300v. 65 m.a., 4v., 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a., C.T., 4v. 1a., C.T.; 19/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-110v. or 200-250v., output 180-0-180v., 40 m.a.; 4v. 1 amp., 4v. 3 amps., 4/6; 200-0-200v., 4v. 1a., 4v. 3a.; 4/6.

PREMIER L.T. Charger Kits, consisting of Premier transformers and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/- complete; ditto, D.C., 47/6.

COLLARO Gramophone Unit, consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job; 15/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000-100,000, ½ meg., any value, 2/-; 200 ohms, wire wound, 1/-.

POLAR Star, manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Utility bakelite 2-gang 0.0005, screened, with uniknob trimmer, 3/6; Polar bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

ORMOND Condensers, 0.0005 2-gang semi-shielded, 2/6; brass vanes with trimmers, 3/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna., 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 16/6; 9in. cone, 22/6.

RELIABLE Canned Coils with Circuit Accurately Matched, dual range, iron cored; 2/11.

UTILITY 3-gang Condensers, 0.0005, fully screened, with trimmers, ball bearing, straight or superhet., 6/9; complete; with disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-; 2 mf., 750v. working, 3/-.

VARLEY Constant Square Peak Coils, band-pass type B.P.7, brand new, in maker's cartons, with instruction and diagram; 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instructions, in original cartons; 2/6.

SCREENED H.F. Chokes, by one of the largest manufacturers in the country; 1/6.

PREMIER British-Made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

(This advertisement continued in third column.)

SOUND SALES

A deep Depression

A DEEP DEPRESSION centred over Radiolympia in 1933, spread slowly but surely over the Radio trade far into 1934. This caused many unfortunate firms to fall out of the industry and yet the completed Annual Audit of Sound Sales, Ltd., shows increased business during the depression. We respectfully suggest that this is due to the fact that a greater number of discriminating Home Constructors have realised that SOUND SALES products—which include Mains Transformers, Chokes, L.F. and Output Transformers, *are better than the advertisement*, also that the majority of Radio Manufacturers depend on SOUND SALES never to let them down or jeopardise their Goodwill, by supplying them with anything but the best Mains Transformers, etc.

IN ADDITION, the G.P.O. together with numerous Talking Film Concerns and Television Companies, pin their faith on SOUND SALES; in other words, the name of SOUND SALES has a very effective double meaning, that is greatly enhanced by the performance of their new 12 watt "Wireless World" Quality Amplifier, which is in every sense of the word a "SOUND" proposition.

SOUND SALES LTD.,
Contractors to the G.P.O., etc.
TREMLETT GROVE, JUNCTION ROAD,
LONDON, N.19. *Telephone: Archway 1661/2.*

THE BEST PARTS FOR THE BEST SETS

Protect your valves and receiver by fitting Belling-Lee Fuses. Attention to all little details will repay you. Have you sent for our free book "Radio Connections"?

The long straight fuse path totally enclosed and the method of fitting the fuse are points in favour of the cartridge type.

Belling-Lee Wanderplugs stay put even in portable sets under vibration. Side entry is provided whereby the copper fray and rubber are all efficiently gripped.

BELLING & LEE LTD
CAMBRIDGE ARTERIAL ROAD, ENFIELD, MIDDX

Components, Etc., for Sale.—Contd.

(This advertisement continued from first column.)

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000 500,000, 2/- each; 1,000 ohm, semi variable, carry 150 m.a., 2/-.

PLESSEY Pick-up and Arm, 15/-; Cosmocord pick-up, with arm and volume control, 10/6.

RELIABLE Intervalve Transformers, 2/-; M.C. Multiratio output transformers, 2/6; 2-1 or 1-1 output transformers, 2/6; microphone transformers, 50 and 100-1, 2/6.

MAGNAVOX Super 66 Power, pentode and push-pull transformer, 2,000 ohm field, £4/4; energised for 200/250 A.C., £5,

BLUE SPOT 45 P.M. Speaker Multi-ratio Transformer, handles 4 watts; listed 45/-, at 25/-; or in handsome walnut cabinet, 35/-.

BLUE SPOT 99 P.M. Speaker Multi-ratio Transformer, handles 5 watts; listed 59/6, at 31/-.

SUPER Moving Coil Speaker by World Famous Radio and Gramophone Co., 10,000 ohm field (300v. 30 m.a.); 25/-; handles 10 watts.

PREMIER H.T.11 Transformer, 500v. 120 m.a., or 450v. 150 m.a., rectified, with 3 L.T. windings, 22/6; with Westinghouse rectifier, 42/6.

DARIO Valves, 4 volt battery type, H.F., R.C., L.F., power, 1/6 each; 4v. directly heated mains power, 1 watt, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers at a fraction of original cost; send for list.

THE Following Lines 6d. each, or 5/- Per Dozen; Chassis valve holders, 5-, 6-, or 7-pin screened screen-grid leads, any value 1-watt wire resistances, wire end condensers, 0.0001 to 0.1, 3 amp. main switches, Cyldon capacitors, double trimmers.

SCOTT Aerial and Anode Coils, dual range, complete with circuit; 2/6 per pair.

BLUE SPOT 29 D.C. Moving Coil, with multi-ratio transformer, 7in. cone, 2,500 ohms, 9/11.

ELPHRO Volume Controls, 10,000, 12,000 or 15,000 ohms, complete with mains switch; 1/-.

T.C.C. Electrolytic Condensers, 8 mf., 440v. working 3/-; 4 mf., 440v. working, 3/-; 15 mf., 50v. working, 1/-; 50 mf., 12v. working 1/-; 15 mf., 100v. working, 1/3; 6 mf., 50v. working, 6d.; 2 mf., 100v. working, 6d.; 8+4 mf., 450v. working, 4/-.

DUBILIER Dry Electrolytic Condensers, 12 mf., 20v. working, 6d.; 50 mf., 50v. working, 1/9.

CONDENSER Blocks, H.M.V., 400v. working, 4+2+1+1+1+0.5, 3/9; 2+2+1+1+1+0.5, 3/-; Dubilier 300v. working, 4+4+2+0.1, 3/-; Philips 6+4+2+1+1, 4/6.

RADIOPHONE Logarithmic Wire Wound Potentiometer, 10,000 ohms, with mains switch, 2/-; S.W. H.F. chokes, 10-200 metres, 9d.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World-famous Continental Valve Manufacturer, all the following standard mains types, fully guaranteed, 4/6 each; H.L., L., power, medium, high, low mag. and variable mu screen grids, 1-, 3- and 4-watt A.C. output, directly heated pentodes, 250v. 60 m.a., full wave rectifiers, D.C. types, 20v. 18 amps., filaments, screen grid V.M., H., H.L., power.

THE Following Types, 5/6 each: 350v., 120 m.a., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½-watt indirectly heated pentode.

THE Following American Types, 4/6: 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27.

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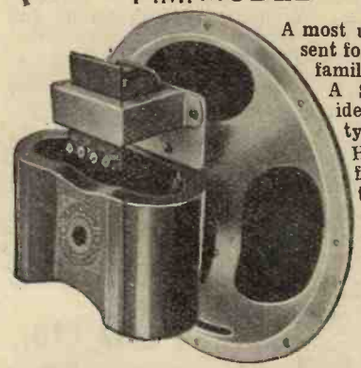

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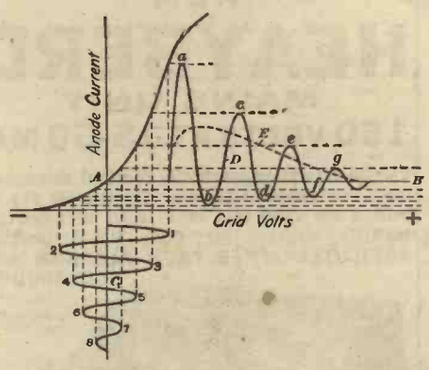

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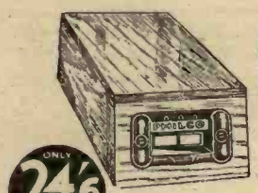

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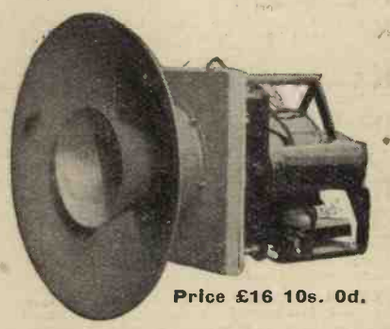

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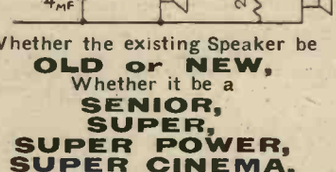

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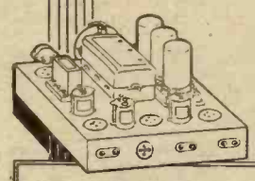

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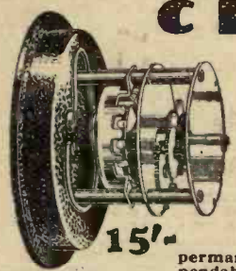

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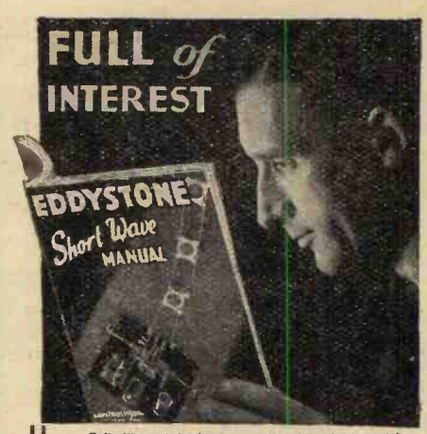

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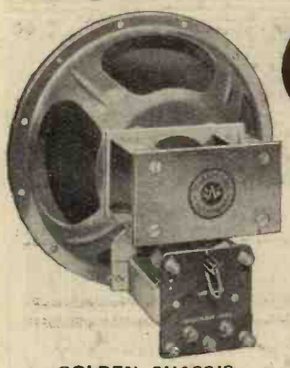

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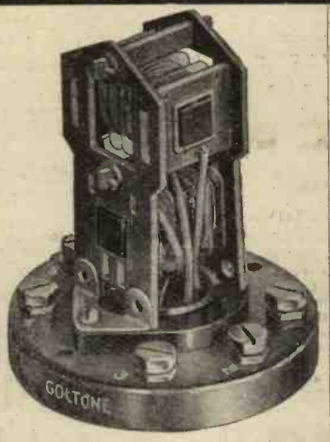

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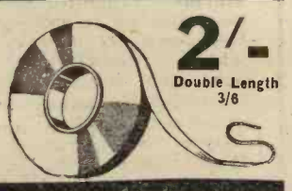

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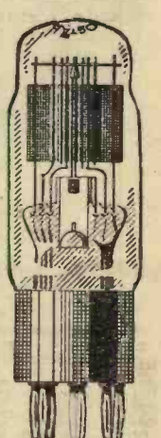

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Printed in England for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by The Cornwall Press Ltd., Paris Garden, Stamford Street, London, S.E.1.
"The Wireless World" can be obtained abroad from the following: UNITED STATES: The International News Co., New York. FRANCE: W. H. Smith & Son, 248, Rue Rivoli, Paris; Hachette et Cie, Rue Réaumur, Paris. BELGIUM: W. H. Smith & Son, 71-75, Boulevard Adolphe Max, Brussels. AUSTRALIA: Gordon and Gotch, Ltd., Melbourne (Victoria), Sydney (N.S.W.), Brisbane (Queensland), Adelaide (S.A.), Perth (W.A.) and Launceston (Tasmania). NEW ZEALAND: Gordon and Gotch, Ltd., Wellington, Auckland, Christchurch and Dunedin. INDIA: A. H. Wheeler & Co., Bombay, Allahabad and Calcutta. CANADA: Imperial News Co., Toronto, Montreal and Winnipeg; Benjamin News Co., Vancouver; Gordon and Gotch, Ltd., 132, Bay Street, Toronto. SOUTH AFRICA: Central News Agency, Ltd.

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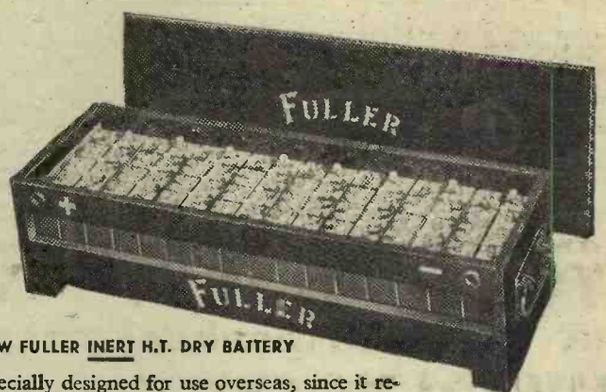

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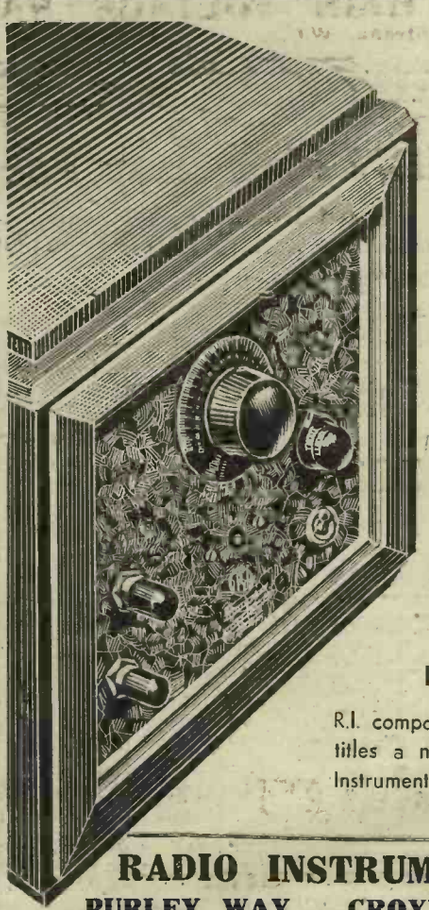

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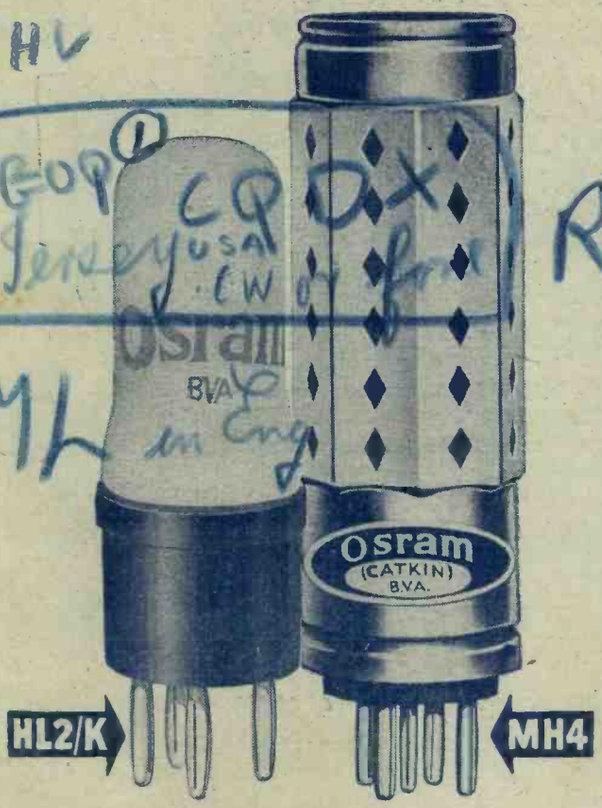

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The Wireless World

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Covering Every Wireless Interest

Friday, December 21st, 1934.

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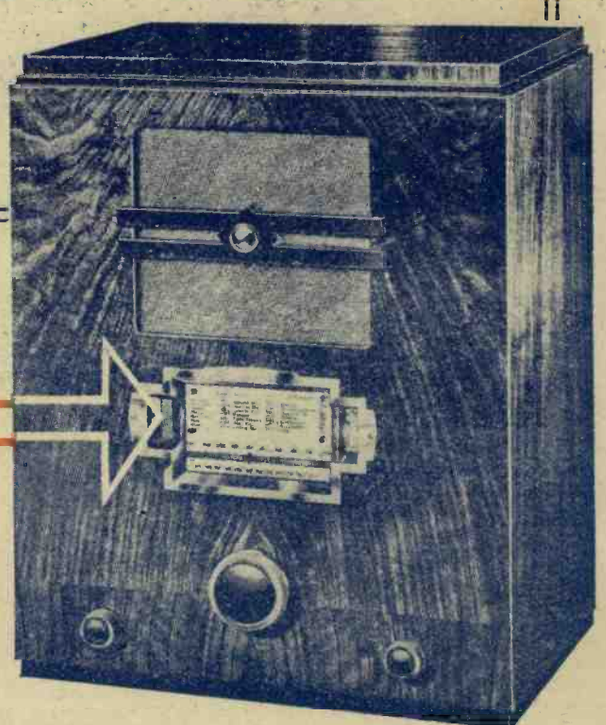

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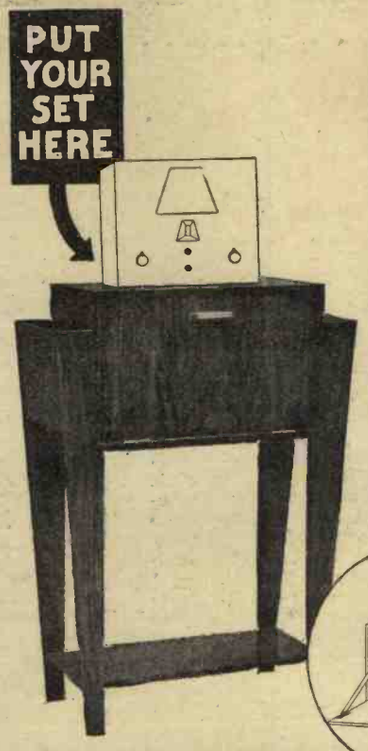

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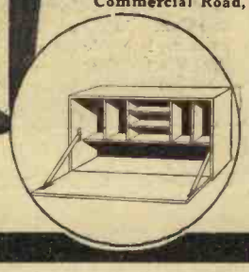

Measurements : 35½" high, 26½" wide, 13" deep, top 20" × 13". Diagram in circle shows interior layout of Writing Desk Note fine arrangement of shelves, etc.

The Wireless World

THE PRACTICAL RADIO JOURNAL

24th Year of Publication

No. 799. FRIDAY, DECEMBER 21ST, 1934. VOL. XXXV. No. 25.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.
Telegrams: "Autocar, Coventry" Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
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GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Operating Receivers

Lack of Essential Knowledge

IN spite of the ever-increasing simplicity of the controls of a wireless set, there are still few receivers which can be described as entirely foolproof in the matter of adjustment if the best results are to be obtained from them.

Recently a good deal has been done by manufacturers in the direction of helping the user of a set. Modern sets no longer have a decoration of unlabelled knobs on the front, the adjustment of which, in the absence of long experience, was in the days gone by nothing but haphazard guessing. Most sets to-day have controls which are easily identifiable, but it is the intelligent adjustment of them which is rare.

There are two principal contributory causes to this state of affairs. In very many cases the manufacturer does not supply adequate literature on how to adjust and tune the receiver, and, secondly, even when he does, very many set users do not take the trouble to read the instructions and acquire the necessary knowledge.

Personal Experiences

Two instances of personal experience may serve to illustrate the point. In one case a new set had been in use for some days and the owners complained of the great variation in strength between one station and another, and the only way they had discovered for varying the volume was by rotating the set, which was a frame aerial type; the owners assured us they had never had any instructions supplied. The second case was of an owner who, although he had had a set for many weeks, had so far failed to appreciate the purpose of a variable selectivity control fitted to the set, even although we found that a very carefully prepared booklet of instructions had been available to him.

These considerations bring us back once more to an old suggestion that instructions regarding the set should, in some way, be permanently attached to it. In the case of many receivers a card of instructions could conveniently be accommodated in the lid of the set; where there is no lid some other convenient place could, no doubt, be found.

Loose leaflets of instructions will invariably get mislaid, and there must be thousands of sets to-day which are performing badly or indifferently due to this cause alone.

Location of the Speaker

The Demand for Separation

OUR recent comments on the advantages of separating the loud speaker from the set have, as usual when we comment on this subject, brought us much correspondence, including a number of letters from trade readers who strongly endorse this view and express the opinion that manufacturers who would advertise the production of a set specially designed to have the speaker located separately would have no reason to regret such a change of policy.

It is quite time that manufacturers paid more attention to the convenience of set users. Accessibility of controls, clear tuning dials and freedom to choose the position of the speaker in a room independently of the set, are three considerations which deserve far greater attention than they have hitherto received.

Measuring Europe's Wavelengths

A Visit to M. Braillard at Brussels

By A. A. GULLILAND

CONSTANT watch is necessary to keep a wave plan in working order. Our correspondent, who has just paid a visit to the Brussels checking station, describes the meticulous measuring operations conducted there from day to day. In an interview, M. Braillard, chief of the checking station, expressed some vigorous personal opinions on Europe's wavelength problems.

The semi-detached dwelling house in a Brussels suburb in which M. Braillard manages to accommodate all the elaborate apparatus of the international wavelength-checking station.

THE decision of the European broadcasting organisation in 1926 to adhere to a common wave plan called the Plan de Genève made it necessary for some international and independent body to check the various frequencies agreed upon. The task of forming such a body fell upon M. Raymond Braillard.

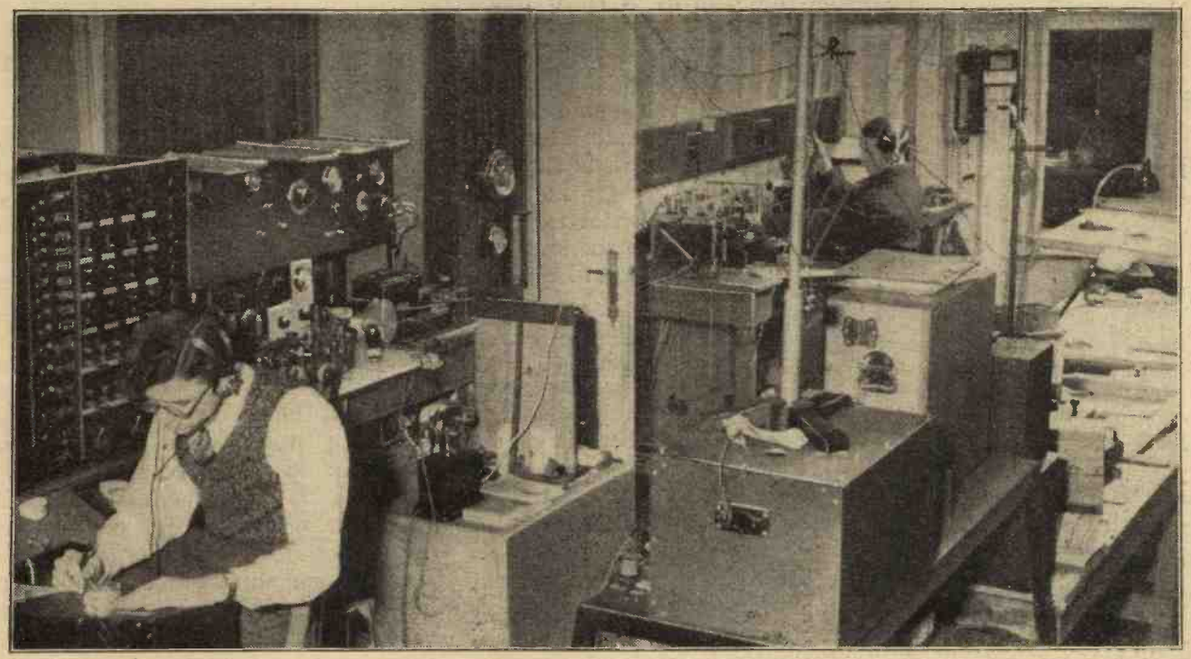
At that time one could not just go out and buy a wavemeter for checking wavelength constancy at a distance, especially if money was a consideration, so M. Braillard had to devise and construct his own wave-measuring apparatus. This was installed in a section of his own private garage. I was privileged to visit this first installation of the UIR; in fact, when taking photos there my great problem was how to take them without having as an eternal background the funnel of the stove which heated the premises.

Later a semi-detached house was taken on the outskirts of Brussels, not far from M. Braillard's private abode. At present, continual additions to the original apparatus have rendered space so limited there as to necessitate plans for building extra accommodation for the checking station.

Because the accuracy of an international checking station must be beyond criticism, M. Braillard has continually improved upon the exactitude of the apparatus. When operations began, accuracy was of the order of 1 in 10,000; to-day it has reached 1 in a million. In other words when measuring a kilometre this is done with an accuracy of plus/minus 1 millimetre. The results of the measurements are regularly published in monthly "graphs."

Wavelength accuracy is only one of the things which are measured at Brussels. Depth of modulation and the reception field strength of the various broadcasting stations and so-called frequency modulation are items which are carefully observed at Brussels. Depth of modulation is measured to provide proof of over-modulation.

Frequency modulation is sometimes a further source of interference as it is just a "wobble" due to modulation



This general view of the interior of the checking station explains more eloquently than words the urgent need for more space. In the left foreground is the frequency measuring gear; behind the engineer is the apparatus for measuring modulation. In the background is the field strength "explorer."

Measuring Europe's Wavelengths—

on older transmitters. Luckily it is not so important now-a-days as modern stations are not subject to it. The field-strength measurements are necessary for obtaining accurate data regarding wave propagation and material for arriving at the future minimum geographical separation of stations.

It would take an article in itself to describe in detail the apparatus used at Brussels. Wavelength measurements are effected by a heterodyne wavemeter, i.e., the signals received by means of a powerful and selective receiver are caused to interfere with a local transmission of known frequency calibrated with the desired accuracy. When the beat becomes zero the reading indicates the wavelength of the transmission being measured. Exactitude being of such great importance, the standard of frequency at the Brussels post is one of the most carefully tended instruments. All the wavemeters used are calibrated every day, and sometimes twice a day. The standard wavemeter, which is regularly compared with signals specially transmitted from the Brussels observatory, consists of a tuning fork driven by a triode valve on a frequency of 1,000 cycles. Pressure and temperature are kept constant.

A Field-Strength Explorer

Field-measuring apparatus with automatic recording on paper strips has been in use at Brussels for several years but the apparatus used has permitted the checking of only one station at a time. M. Braillard and his scientific adviser Professor Divoire have now completed an ingenious instrument which they call a field-strength explorer. It consists, in the main, of a modified super-het. receiver with tuning controls driven by a special mechanical device providing a paper record of the reception field-strength of all European broadcasting stations receivable in Brussels. As the cycle of exploration takes only 11 minutes, one obtains graphical records showing the fluctuations in reception field-strength at regular time intervals throughout the evening. Calibration has to be exact to be able to obtain absolute values, so the paper band on which recording takes place is carefully marked from a known standard at least once a day. The result of these measurements, which started only a month ago, are plotted on graphs and will be circulated to the various stations.

The latest portrait of M. Raymond Braillard, head of the International Broadcasting Union's wavelength checking centre at Brussels.

(Left) The results of each month's wavelength checking are carefully recorded on graphs which are circulated to the European postal administrations.

M. Boulanger, head of the checking department, with the apparatus used for measuring and recording the modulation depth of every European broadcasting station.

A Cause of Interference

M. Braillard mentioned a curious phenomenon at the time of my visit. He told me that the field strength of a number of stations was nearly double that of the same stations during the corresponding period of last year. He attributes this effect to greater solar activity. Unfortunately the natural result is greater interference between stations than was originally expected. Mühlacker, for instance, has some 24 milli-volts field-strength in Brussels. This increase is in no relation to the power increase of from 60 to 100 kW. Droitwich is very much stronger than Daventry. But here again the present 19 milli-volts measured at Brussels is far greater than theoretical calculations would lead one to expect.

This remark by M. Braillard led to a question which he had probably been expecting. I asked him for a solution of

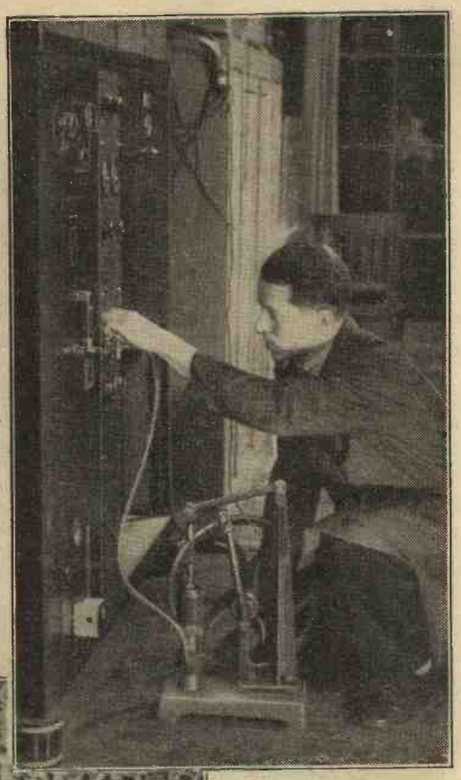
Measuring Europe's Wavelengths—

the European wavelength problem. He smiled and told me that from past experience I ought to know that he usually answered such questions with a remark as to the weather, but added that if I took him in his private capacity as an engineer with a wide experience of broadcasting, and not in his official capacity, he would give me a brief outline.

"The Lucerne Plan," said M. Braillard, "is working satisfactorily. After all, one must always bear in mind that without it the European ether would be in a state of chaos."

To my remark that some time in 1936 there would have to be a successor to the present wave plan, M. Braillard replied that by then there would be scientific data available regarding wave propagation, anti-fading aerials and single wavelength broadcasting which had not been available at the time of the Lucerne plan in 1933.

"To my mind," M. Braillard continued, "there will have to be, in future,



An engineer checks the pressure in the chamber containing the tuning fork which provides the frequency standard for calibrating wavemeters.

In the archives at Brussels. Wavelength charts for each station have been kept since 1930.

a marked improvement in the quality of reproduction of receiving sets. The high frequencies are the salt and the pepper in the soup, and they make all the difference between unintelligibility and intelligibility of speech. We must have a wavelength separation of anything between 16 and 20 kilocycles!"

My face must have registered surprise for M. Braillard quickly reminded me that he was speaking as a private engineer, not as an official. "In all probability," he added, "receivers would best be equipped with variable band-pass, permitting of quality up to 8,000 cycles for high-power local stations but only letting through 3,000 to 4,000 cycles for distant reception.

"Reduction in the number of wave channels would be the natural outcome of better quality." M. Braillard continued, "To obtain this the new anti-fading aerials have made the formerly despised waves under 300 metres extremely sought after. It is not everybody who can build masts 300 metres in height as at Budapest."

On the other hand, he went on, anti-fading aerials give very considerable local range to the shorter waves. Countries hitherto clinging to their 400 or 500 metre waves would be willing to accept shorter ones. Better quality would require sacrifices, M. Braillard said. Each country would have to be content with a small number of high-efficiency, high power, broad-frequency-band stations and a large number of low-power, local relays either synchronised along cables or by means of independent devices. Possibly some countries would resort to the ultra-short-wave for their local stations, combining the service with television.

"Synchronisation on international common waves does not present technical problems any more," said M. Braillard, with a smile at my remark that at Lucerne last year numbers of delegates had not believed that it would be possible to keep within plus/minus 10 cycles of an allotted wave. M. Braillard told me that there were a large number of stations which, in the course of the past year, had never varied more than 5 cycles and, in fact, things had continued to improve. At the present moment the Vienna station has kept its frequency steady for four weeks without wobbling even as much as one single cycle!

"My opinions may be of the future," M. Braillard concluded, "but they are of the very near future. When speaking of radio please always bear in mind the thing which I told my students at the university the other day: In radio one ought never to try to get five hams out of one pig."

Thus speaks M. Braillard, who can well be said to be Europe's leading international expert on the practical operation of wave plans.

Before I left him, we spoke of our first meeting five years ago, and I remarked that after all he had not changed much.

"But look," he exclaimed, "look what those wave-plans have done to my hair. It is grey now!"

THE RADIO INDUSTRY

WORK is proceeding on the erection of a new Ekco factory to be devoted to the manufacture of car radio sets and to the equipment of vehicles. With the latter object in view flexible exhaust-pipe extensions are being installed, so that car engines may be run indoors without fear of fumes.

◇ ◇ ◇ ◇

"Wireless Without Crackling" is the title of a new booklet dealing with electrical interference that has just been issued by Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex. Free copies will be sent to readers on request.

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A booklet entitled "Piezo Electricity" (price 9d. post free) has just been issued by R. A. Rothermel, Ltd., Rothermel House, Canterbury Road, London, N.W.6. The scope of this interesting publication is adequately described in the subtitle: "A Technical Treatise on the Applications of Rochelle Salt Crystals to High-fidelity Sound Reproducers."

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The General Electric Company has recently found it necessary to extend the facilities for battery manufacture at their works at Witton; the battery factory now covers an area of 45,000 square feet and is planned on the most modern lines for efficient production.

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Leaflets received from the Cressall Manufacturing Company, of Eclipse Works, 31-32, Tower Street, Birmingham, 19, describe a new pattern of sliding resistance and also the well-known Cressall asbestos-woven resistance mats.

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A Correction.—The price of the Murphy radio-gramophone is £24, and not 24 guineas, as given in our Guide to Receivers.

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The Voigt twin-diaphragm speaker with 2ft.-mouth horn has been approved by the Central Council for School Broadcasting. The relatively high sensitivity of this model will often be beneficial.

Alternating Currents, by Leo T. Agger, B.E., head of the Electrical Engineering Dept. at the Municipal College, Leigh.—While mainly intended for students, the author's treatment of its subject renders this book suitable for others who wish for an introduction to alternating current theory and practice. The author assumes the reader to be already familiar with the phenomena associated with DC currents. Pp. 204+viii, with 146 diagrams. Published by Messrs. Macmillan and Co., Ltd., St. Martin's Street, London, W.C.2. Price 5s. net.

The Universal Receiver

Design of Interchangeable AC-DC Sets

By F. R. W. STRAFFORD

IN addition to describing the somewhat puzzling arrangement of the rectifier valve, which, in a universal AC-DC set, is operative on AC but a "passenger" on DC supplies, the present article also deals with the finer points in the design of this specialised type of receiver.

AS its name implies, an AC/DC receiver is characterised by its independence of the nature of the mains supply to which it is connected. The method by which the necessary smoothed direct-current HT supply is obtained in this type of receiver is exceedingly simple, as may be seen by referring to Fig. 1.

The rectifier valve is first distinguished by the fact that its emitting cathode is indirectly heated, and the necessary heater current is supplied from the mains

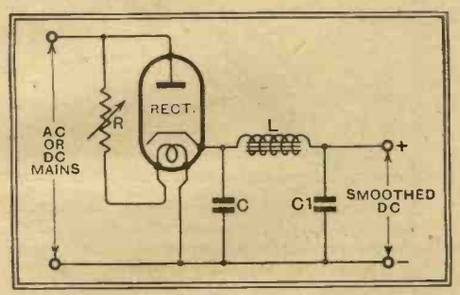


Fig. 1.—Usual connections of the rectifying valve in a universal receiver.

via a voltage-dropping resistance R, adjusted to give the requisite working conditions for the heater.

When it is connected to AC supply mains the rectifier acts as a simple half-wave system, the valve becoming conductive only when its anode receives a positive half-cycle of voltage. The condenser C receives unidirectional pulses of current and a mean voltage is set up across it. There is, in addition, the usual arrangement for eliminating ripple, which is smoothed out by the filter circuit L and C1.

The Inoperative Rectifier

For DC operation one merely inserts the mains plug in such a manner as to connect the positive of the supply to the anode. The rectifier valve then becomes permanently conductive and may be replaced by a simple resistance, the value of which must simulate the average internal slope impedance of the rectifier which is especially designed in order that this value may be kept at a minimum. This ensures good regulation, and a very small voltage drop across the rectifier valve results.

Naturally, since the supply voltage is unlikely to exceed 250 volts, it is essential in the AC/DC receiver to avoid serious loss of voltage, or the available supply to the anodes of the valves will not be great enough to produce good results. Nevertheless, "universal" receiver valves have been specially designed to work at nominal anode voltages of 150 or even less, so that 50-100 volts may be dropped across the smoothing choke, which may accordingly be replaced if required by the field coil or an energised type of moving-coil loud speaker in the usual manner.

General considerations of valve design and circuit networks has led to the adoption of higher heater voltage than normally utilised for indirectly-heated valves.

For example assuming that one attempted to use the 4-volt 1-amp valve in an AC/DC receiver employing 5 valves on a mains supply of 220 volts. If these valves were placed in parallel one would require a series of resistance capable of dropping 216 volts at 5 amps! This represents 1,080 watts, the consumption of an excellent electric fire! To house such a resistance in a cabinet would be a somewhat hazardous procedure! Even if these valves were connected in series the resistance would be required to produce a voltage drop of 200 at 1 amp, which represents 200 watts of heat dissipation across it! The valves are therefore designed to work at a low current and higher voltage, so that in a receiver employing, say, 5 valves, including the rectifier, they are connected in series, and the final series resistance will not have to drop much more than 100 volts or dissipate more than 30 watts.

One may now refer to Fig. 2, which represents the bare bones of an AC/DC receiver.

An AC/DC receiver differs from AC mains sets in that the chassis is often at high potential with respect to earth. It is *absolutely essential*, therefore, to connect the earth, for the receiver, *via* a suitable high-voltage condenser and to box up the receiver in such a manner as to completely eliminate any possibility of making human contact with the chassis or any metal part connected to it.

The remaining circuit connections are quite normal and do not differ from those of any other type of mains receiver employing indirectly-heated valves. The position of the heaters with regard to their series arrangement in the heater chain is, however, very important. For example, supposing the heater marked X in Fig. 2 belongs to a valve used as a detector or sensitive low-frequency amplifier; this heater is at relatively high potential to the chassis, and during AC operation a small current will be driven from heater to cathode *via* the heater/cathode capacity and will produce AC potential across the bias resistor normally connected in the cathode return to chassis. Unless extremely elaborate decoupling arrangements are employed, the resultant AC potential will be amplified and produce serious hum in the receiver.

Induced Interference

Hum can also be produced by pure magnetic induction, which develops AC voltage across part of the electrode structures in the valve itself. It is therefore desirable to place valves which are sensitive to low-frequency potentials at the end of the heater chain nearest the chassis.

The frequency-changer is also liable to produce modulation hum if it is connected at too high a potential with respect to chassis. The output valve, which has a relatively low voltage gain when matched for maximum power output, may be placed at high potential, and very little hum trouble is likely to arise

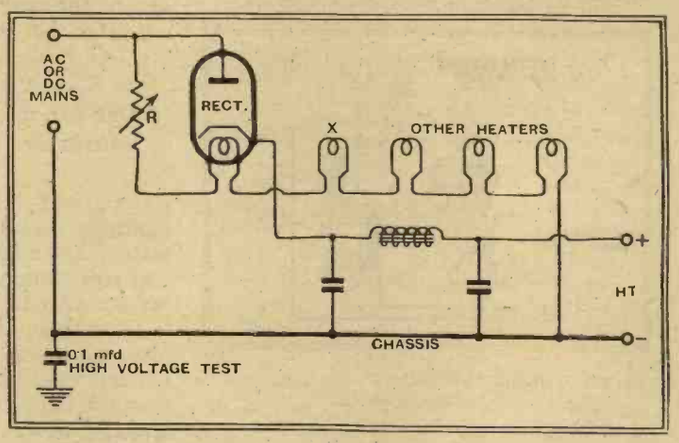


Fig. 2.—Wiring of the LT and HT supply circuits.

from this source. Since the major portion of hum voltage is due to the capacity between heater and cathode, which is unavoidable in present design, it is essential that there should be no pure conduction paths between these t /o electrodes, or the

The Universal Receiver—

hum problem becomes increasingly difficult. Pure conduction paths, as distinct from reactances, may be caused by faulty insulation or actual electron emission between heater and cathode, but valve manufacturers are watching these points very carefully, and such faults are very unlikely to occur.

The saving of cost due to the elimination of a mains transformer from the AC/DC receiver marks it down as a definite progressive step in the manufacture of a high-class receiver of medium power output at an attractive price. It has opened up new avenues for valve design, and is likely to become increasingly popular, as its reputation is already well established.

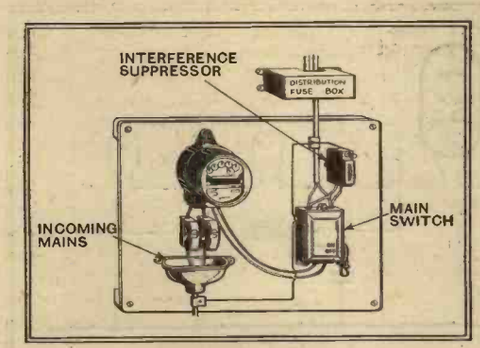
HINTS AND TIPS

Practical Aids to Better Reception

A GREAT deal has been written on what the wireless user can and cannot do to minimise the effects of electrical disturbances. The desirability of applying preventive measures at the source is generally admitted, but it is also agreed that at least something can often—but not invariably—be done at the receiving end. But this is admittedly rather an unsatisfactory state of affairs, and the attitude of many sufferers seems to be that, as everything seems so uncertain, there is a good excuse for inaction.

The Listener's Part

This attitude is surely wrong. Indeed, it may almost be urged that no one is entitled to complain until he has tried to help himself by applying the simpler remedies. At any rate there is some justification for this statement with regard to weak interference, of such an intensity that it does not affect the reception of local broadcast, but may be a serious bar to successful long-distance work. The Post Office authorities can hardly concern themselves with such interference, and it is natural that owners of apparatus causing it are less likely to go to the expense of providing suppressors than in cases where short-distance reception is interrupted.



Fitting a Belling-Lee interference suppressor to incoming mains.

Although comparatively elaborate methods of interference suppression are suggested from time to time, the less experienced listener hardly need concern himself except with two simple ones—the condenser filter for the household electrical mains and the screened down-lead for his aerial.

As most readers are aware, nothing could be simpler than the condenser filter, which consists of a pair of 1-mfd. or 2-mfd. condensers joined in series and connected across the mains as near as possible to their point of entry to the building. The junction point between the condensers is then joined to earth. Ready-made suppressors, comprising a pair of condensers with safety fuses, all mounted in a neat case, are produced by several firms.

So far as screened aerial down-leads are concerned, the sufferer from interference has two alternatives to consider. Ordinary rubber-covered and metal-braided wire normally introduces heavy losses, which must accordingly be offset by providing matching transformers (which are obtainable commercially) at each end of the screened line. Low-capacity screened cable, on the other hand, is specially made to reduce both self-capacity and losses, and, in reasonable lengths, may be used in the normal manner, but, of course, the external metal screening must be earthed.

A LOW-READING DC voltmeter is seldom of much practical use to the owner of a modern receiver—at any rate, one of the mains-operated type—as it is not often that the need arises for measuring DC voltages of the order of two or three volts. It is worth while remembering, however, that in many cases such an instrument can be pressed into service as a sensitive tuning indicator which will be quite as satisfactory as the more usual milliammeter, and will certainly be rather easier to instal in the set.

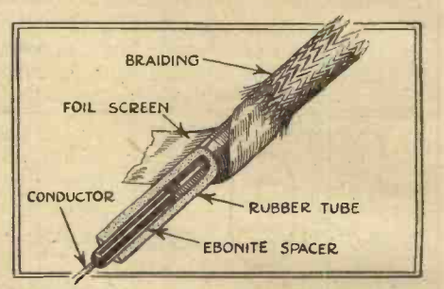
Use for a Voltmeter

The meter should preferably have a maximum scale reading only slightly greater than the "standing" negative bias applied to the valves controlled by the AVC system in the absence of an incoming signal; 3 or 4 volts is generally right. The instrument, which should be of high resistance, is merely joined across the bias resistor of one of the controlled valves (or across a resistor common to more than one valve). Accurate tuning will then be indicated by minimum deflection of the needle.

AFTER converting an existing set to Class "B" output by making the original small output valve become the driver, it occasionally happens that the resulting quality is disappointing. In spite of meticulous care in the choice of values and components in the Class "B" stage, and the usual precautions against parasitic oscillation, the reproduction is poor if not definitely bad, and overloading appears to set in long before the rated output is reached.

Class "B" Quality

In such a case it is highly probable that low-frequency feed-back is occurring in the earlier stages, and the remedy is to increase the decoupling of the detector or driver valve, or possibly of both. As HT volts are likely to be rather precious in a battery set, it is usually advisable to increase the values of by-pass condensers rather than those of decoupling resistances.



A method of providing air spacing (with consequent reduction in losses and self-capacity) for the conductor of screened aerial cable (Ward and Goldstone's "Metocel").

THOSE who are forced to use a mains aerial—and this paragraph must not be construed as condoning the practice—should always try the effect of reversing the mains plug through which the set is fed. In most cases, polarity will have a noticeable influence on signal pick-up.

Mains Aerials

Of course, this advice applies only to AC mains; polarity reversal of DC supply would render the receiver inoperative. There remains the possibility, however, of trying an experimental change-over of the wire which connects the built-in "mains aerial" condenser to one or other of the mains leads.

EVEN those with little experience in the construction of HF amplifiers will know that grid and anode wires are to be regarded as probable sources of unwanted couplings which are likely to lead to instability. It is not so often appreciated that leads at the "earthy" ends of high-frequency circuits may also cause trouble, even though they are connected to a metal chassis, and so appear innocuous. This is particularly likely to be true of wires forming part of a closed oscillatory circuit which are connected to tuning coils or condensers.

Stray Couplings

Current Topics

Events of the Week in Brief Review

Catacombs Broadcast

AT 5 p.m. on Christmas Day a special service in the Catacombs at Rome is to be broadcast to America for distribution over the network of the National Broadcasting Company.

150 Kilowatts from Paris

WE learn that Radio-Paris (Paris National) will be the most powerful transmitter in the French regional scheme, using the maximum power permitted by international agreement, namely, 150 kilowatts.

Our Near Neighbour

RADIO-RENNES (Normandy), with its provisional power of 40 kilowatts, has been renamed "Radio-P.T.T. Ouest." This temporary transmitter is filling the breach pending the completion of the 120-kilowatt Regional station, which will begin operation early in the New Year.

Farewell to Huizen

HUIZEN is to close down, according to arrangements decided upon by the four Dutch broadcasting associations at a meeting presided over by the Minister of the Interior, M. de Wilde. The arrangement provides for the operation of broadcasting stations by an organisation comprising all four associations, but under State control.

The power of the State station Kootwijk will be increased so that it will eventually replace Huizen.

"Photograms of the Year"

THE annual appearance of "Photograms of the Year" is always looked forward to by lovers of artistic photography. The new edition, which marks the fortieth year of publication, emphasises the international appeal of photographic art. Critical notes are included, and a very complete and up-to-date directory of photographic societies.

"Photograms of the Year" should make an ideal Christmas gift book for every photographer. It is published by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1, price 5s. paper covers, 7s. 6d. cloth-bound, and is obtainable direct from them (postage 6d. extra) or from all booksellers, bookstalls, and photographic dealers.

Overseas Census

NO attempt seems to have been made to assess the number of listeners to the B.B.C. Empire stations. A census has been conducted, however, in the French Colonies, with the result that only 1,533 short-wave receivers are known to exist throughout the French overseas territory.

Norway's Broadcasting House

NORWAY is the latest country to consider the building of a Broadcasting House, which will be erected in Oslo. An architects' competition has been inaugurated, and the best designs are to be discussed in the Norwegian Parliament.

Yet Another

AUSTRIA now claims to have produced the smallest wireless receiver in the world. According to a correspondent, it is the size of a thimble.

Radio on Viceroy's Plane

THE new four-engine Avro monoplane built and equipped specially for the Viceroy of India is fitted with Marconi combined medium- and short-wave transmitting and receiving apparatus, with the Marconi "homing" device attachment as an aid to navigation.

The transmitter and receiver, Type A.D.37/38, are capable of both telephone and telegraph communication on the dual wave ranges of 40-80 and 500-1,000 metres.

MICRO-BEAM TRANSMISSION on a half-metre wavelength being demonstrated by Mr. Albert Parsons, of the Portsmouth Municipal College, at the local Industries Exhibition.

A Portuguese Show

TWENTY-FIVE American radio manufacturers displayed their products at Portugal's fifth radio and electricity exhibition held in Lisbon from December 1st to 10th. There were three British, three German, one Dutch, and one Austrian stands.

According to a correspondent, there were no novelties. All-mains sets were in the majority. Car radio was prominent.

The *Emisora Nacional* exhibited a glass-walled, sound-proof broadcasting studio from which programmes were transmitted in full view of an interested audience.

President Opens Short-wave Station

A NEW Portuguese short-wave statio, CT1GO, owned by the Portuguese Radio Club, Parede, is now operating on 48.4 metres (6,198 kilocycles) and 24.2 metres (12,396 kilocycles).

The former transmits daily (Tuesday excepted) from 0.20 a.m. to 1.30 a.m., and on Sundays from 4.30 p.m. until 6 p.m. The latter operates on Tuesdays, Thursdays, and Fridays from 6 to 7.15 p.m., and also on Sundays from 3 to 4.30 p.m. All times are G.M.T.

The station was inaugurated on December 1st by the President of Portugal

An Echo Depth Recorder

"A MAGNETO-STRICTION Echo Depth Recorder" is the title of a paper by A. B. Wood, D.Sc., F. D. Smith, D.Sc., and J. A. McGeachy, B.Sc., to be read at a meeting of the Wireless Section of the Institution of Electrical Engineers at 6 p.m. on Wednesday, January 2nd, at the Institution, Savoy Place, Victoria Embankment, W.C.2.

Earlier Radio Show

FRANCE is to set the fashion in early radio exhibitions, for in all probability the official radio show of 1935 will take place in June.

Reasons adduced in favour of the change from September include the longer period between the show and the opening of the season, enabling manufacturers to cope with the probable demand. From the point of view of the public the June date coincides with the height of the Paris social season.

Plea for Silent Nights

OCCASIONAL silent nights on the ether are vital to American trade in the opinion of Mr. Irving Caesar, the Broadway song writer and music publisher, who contends that the stay-at-home habits induced by radio mean that people wear out fewer shoes, suits, and evening gowns, consume less petrol, and attend theatres less frequently. Mr. Caesar's paper, delivered before the Federal Communications Commission recently, was entitled "The Lethargy of Radiocracy."

Collins' Wireless Diary

THE Collins' Diaries are famous, and the Collins' Wireless Diary for 1935 follows the worthy tradition. In addition to the diary space, there are 146 pages devoted to useful wireless information, formulæ, and lists of wavelengths. The diary is obtainable from all booksellers and stationers, price 1s. 3d., in art cloth. There are other prices for superior bindings.

A Lost Ticket

THE Birmingham reader who lost a return half ticket from London on Tuesday, December 11th, is asked to communicate with *The Wireless World*.

The Power Unit

Considerations Underlying the Choice of Components for Mains Equipment

WHILE receiver design has progressed at a breathless pace during the last few years, the mains power unit remains essentially the same. The changes that have been made are confined almost entirely to manufacturing details. As it has not been the focus of attention, therefore, there may be room for a review of this department. What follows does not pretend to cover the whole subject of design; that can safely be left to the manufacturers of the large selection of components available for building power units. But sometimes we may not want to stick rigidly to the constructional specification (there may be components from a scrapped set, for example) and it is as well to know where latitude is allowable and where it is not.

It is bad policy to try and cut costs in any part of a receiver, but more emphatically so in the power unit. It must not be forgotten that the voltages generated in a unit of even moderate power are enough to cause quite a lot of damage, human and otherwise, in the event of a breakdown of insulation. For the same reason one can hardly take too much care in assembling and wiring, and in running preliminary tests.

With this in mind we may turn to consider safety devices, such as fuses. Small lamps are all very well for battery circuits, but they do not guarantee a complete disconnection in a mains circuit. There is another difficulty: a sudden surge of current is liable to flow at the moment of switching on, and is quite normal; but a flash-lamp filament contains so little metal that it is fused by even a momentary excess current. A cartridge fuse has been standardised, and is designed to blow at 50 per cent. more than the rated current. The pair of fuses (one in each main) between the supply and the primary of the power transformer should be rated at considerably more than the actual normal current, to carry the surges—1 amp is usual up to 60 watts, and higher powers *pro rata*. Very cunning fuse holders are made to take one or a pair of fuses, which are totally inaccessible until the part carrying them is pulled out; and the operation disconnects both sides of the supply and entirely disconnects the fuses. It is difficult to see how anybody can blunder into "death by misadventure" with such a fitment. Belling and Lee, and Microfuse have specialised in this sort of equipment for a long time.

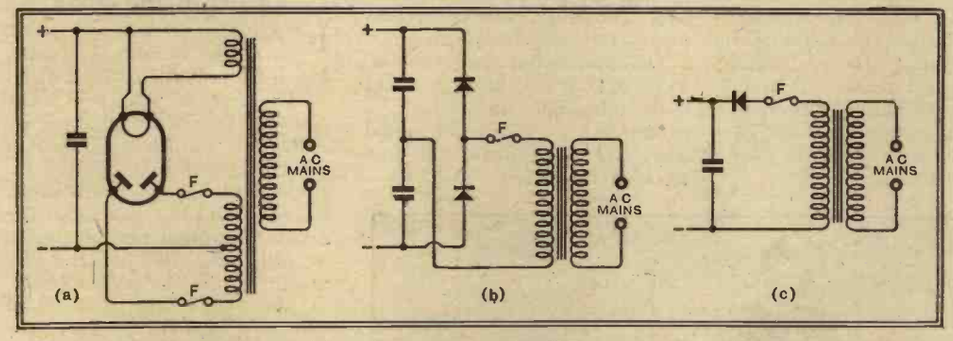


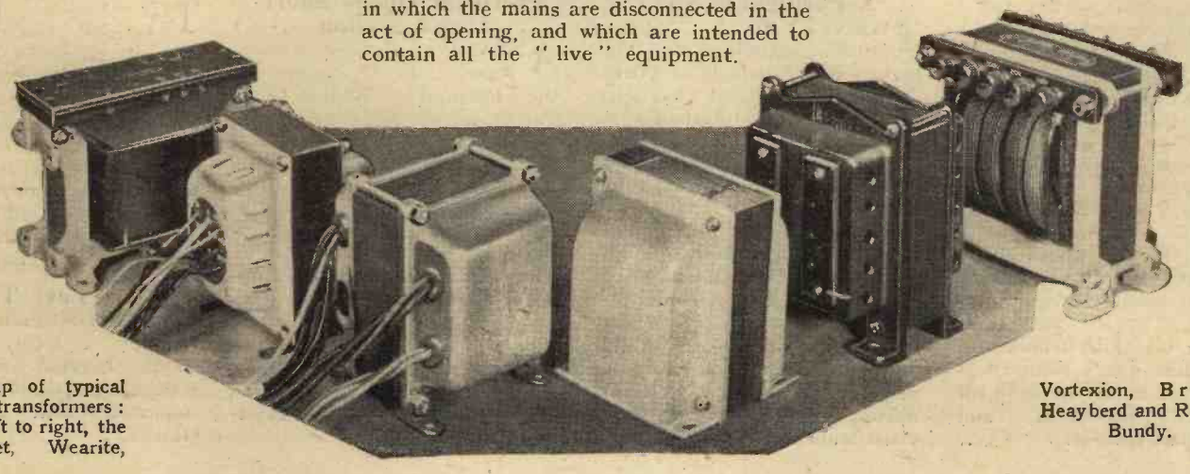
Fig. 1.—F indicates fuse positions for protecting the H.T. circuit with (a) a full-wave valve rectifier, (b) a voltage-doubling metal rectifier, and (c) a half-wave rectifier of either sort.

For the HT rectifier circuits the fuses may be rated more closely to the actual current—say a 150 mA. fuse for an 80 or 100 mA. circuit—and so give more responsive protection. The proper place is in the leads to the anodes of the rectifier (Fig. 1). An effective protection against shock is provided by the safety boxes made by Ferranti, in which the mains are disconnected in the act of opening, and which are intended to contain all the "live" equipment.

Indirectly heated rectifiers are now in general use in the moderate sizes, so a thermal delay-switch to keep the HT current back until the other valves have warmed up is not usually necessary; but in big units the rectifier may pass current before the power valves are ready to take it; and the result for a little while after switching on is that the voltage applied to the smoothing condensers is anything up to 50 per cent. above normal. That is in addition to possible momentary surges. So a delay-switch, such as is made by Varley, sometimes enables one just to use a certain type of condenser when otherwise the risk would oblige one to fit a higher voltage type, at greater expense.

This sort of difficulty has been largely evaded by the tendency to standardise all components to a few voltages—chiefly 250, 350 and 500. Another great help is the electrolytic condenser, which has practically superseded paper condensers for smoothing (C1 and C2 in Fig. 2). To work on a 350 volts smoothing circuit a paper condenser should be rated at a working voltage of not less than 500, and this means a test voltage of at least 1,000. An electrolytic condenser rated at 500 volts peak is perfectly safe. Even an electrolytic condenser is not happy if the excess voltage persists. There is a chance of this when a high voltage is reduced by a series resistance for feeding a valve in one of the early stages. The valve may go out of business and cause the voltage across the condenser to rise very considerably (C3 in Fig. 2). Condensers used in this way ought to be able to stand the full voltage that would exist if the resistor were not present, but one need not provide for surges on top of this.

There is one position where a condenser is especially liable to be broken down, with almost certainly regrettable results. It is



A group of typical mains transformers: from left to right, the Davenset, Wearite, Vortexion, Bryce, Heayberd and Rich & Bundy.

The Power Unit—

the so-called buffer condenser sometimes used as a cure for modulation hum (the sort that is heard only when a station is tuned in). C4, or alternatively C5 (in Fig. 2) shows where it is connected. Sometimes only one condenser is used, instead of a pair. The capacity is usually 0.1 mfd., and it is not too much to call for a test voltage 10 times the rectified voltage.

The other component in the smoothing partnership is the choke. It has become almost standard practice to use the loud speaker field coil as a choke, which may or may not render an ordinary choke superfluous.

There are too many ways of connecting a field coil, with or without additional chokes, to illustrate here. One of them was adopted in the Single Span receiver; in which a choke is used for all the HT current, and the current to the stages other than the output valve is further smoothed by the speaker field. For ordinary purposes, however, the simple circuit of Fig. 2 is satisfactory. But if a choke is needed, it is quite essential to get it from a manufacturer who knows all about the job, and to see that it is rated to carry the maximum HT current.

Quite a different sort of choke sometimes finds its way into power units. There may be trouble with "noisy" mains—high-frequency disturbances working along into the radio circuits via the mains. This is particularly likely with DC supplies; and suppresser chokes and condensers are available to make up filter circuits such as that shown in Fig. 2 (C6 and L). Sometimes only condensers are used, or they are placed at the other side of the chokes. The chokes must be designed to impede HF currents, and to carry the full supply current to the unit. Wright and Weaire, Goltone, and some other firms list a range of chokes for this purpose.

With AC mains there may be no need to do anything as elaborate as this; it may be enough to use a transformer with an earthed screen between the windings. But before we can say anything much about transformers, however, we have to decide between valve and metal rectifiers. These two competitors have been in the field for more than half a dozen years, and there are still no signs that either is going to oust the other. The advantages seem remarkably well balanced, and the casting vote is usually in the hands of special local circumstances.

A metal rectifier is more expensive and bulky than a valve, particularly when one takes into account the extra condenser capacity required in a voltage-doubling circuit. And a short-circuit is likely to be a more expensive sort of accident when a metal rectifier is used. But there are the advantages of robustness and permanency. Moreover, the valve rectifier needs an extra LT winding on the transformer, and a much higher voltage HT winding.

When using a valve rectifier, the habit of regarding the LT parts as "earthy" and harmless must be broken; the rectifier filament circuit is very nearly the "hottest" part of the whole arrangement, and should be particularly well insulated throughout. Another habit is to wire up a receiver with 22 gauge or thereabouts, which is more than adequate for most of the currents to be borne; but it must be remembered that a rectifier filament may take several amps, and unless heavy gauge wire is used there will be a drop in the voltage at the filament.

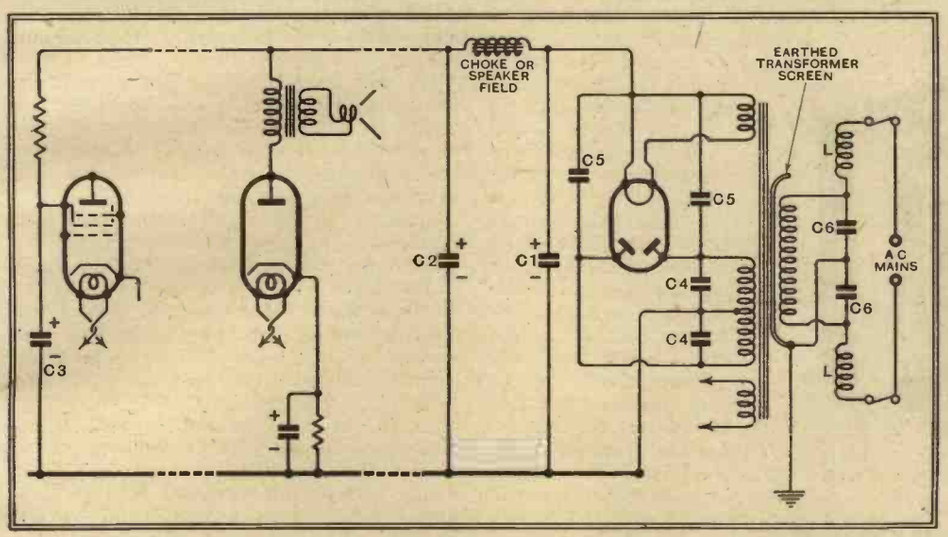


Fig. 2.—Circuit diagram of a typical power unit, showing positions of various condensers that may be used.

It is not always realised that the life of a rectifier is shortened by low LT voltage as well as by high. For the same reason take care that there are no high resistance contacts, not forgetting the valve holder.

A Westinghouse metal rectifier is shown with a group of modern full-wave rectifier valves.

Incidentally, the main LT to the receiver is likely to take more current still, and perhaps the valves are situated in a separate unit a little distance away; so the leads should be generous in copper. Something equivalent to at least No. 16 gauge is advisable. The gauge of the HT wiring is unimportant, except perhaps for mechanical strength; it is the insulation that counts here.

Universal Receivers

Turning now to the power transformer, it may be asked whether it is really necessary. "Universal" receivers, working on either AC or DC mains without alteration, have no transformer; and they work well if they are properly designed. On DC, of course, a transformer has no application at all; and that constitutes a disadvantage which is compulsory. When a receiver is worked on AC without a transformer, it is a voluntary disadvantage, suffered for the sake of being able to use either type of supply, or possibly for the sake of saving the cost of the transformer. But a disadvantage it is; and for at least three reasons.

The first is that without a transformer the parts of the receiver are in direct connection with the mains; and it is not possible to make them safe to touch by earthing them, because that might short-circuit the mains and put an end to the matter. Using a transformer, the whole set is isolated from the mains, and the high-voltage parts can readily be made inaccessible.

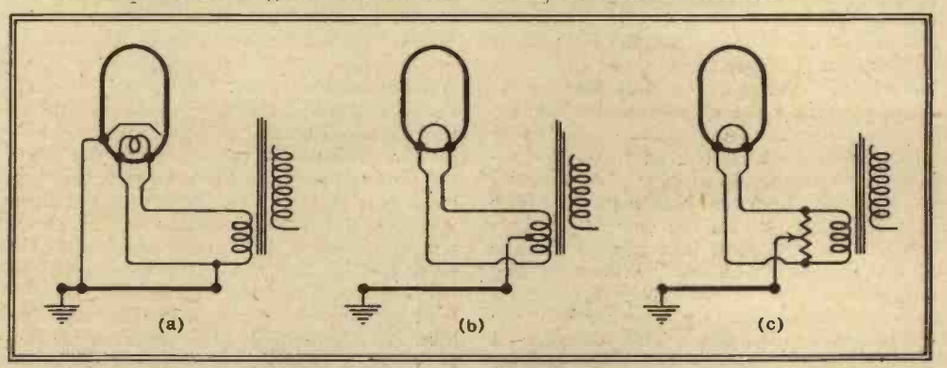


Fig. 3. The LT winding for an indirectly heated valve is often connected to the rest of the circuit at one side (a), but with directly heated valves the connection must be made to a centre-tap (b), or potential divider (c).

The Power Unit—

Next, the voltage available for the receiver is limited to twice that of the mains; and if it happens to be 110 there is not much scope for working modern valves.

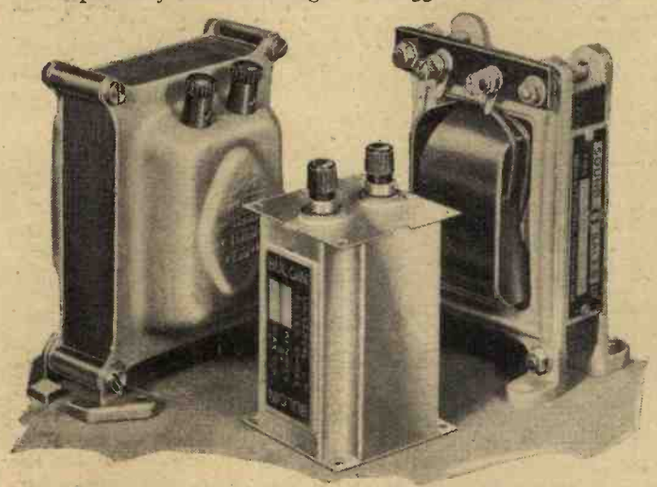
Then there is a further limitation in not being able to obtain *low* voltage supplies; for example, those needed for valve heaters. In the range of " universal " valves there is not such a large choice, and the series connection of the heaters is less satisfactory.

That is not to say that transformerless receivers cannot be quite comparable with good AC models of normal design; but they require a good deal of experience to design; and the amateur should not neglect the red light of warning that must be suspended over this district of radio.

Mains Transformers

There are too many makes of reliable transformers to name, and such a large variety of specifications to choose from that a special model is seldom necessary. But when one does want to get materials for special transformers or chokes there are firms such as Sound Sales who can supply these, or make up transformers to special requirements. Partridge and Mee specialise in the latter.

It is probably obvious enough that a 350-0-350 volts winding is one giving 700 volts and provided with a centre tap so that there are 350 volts between it and each outer terminal. Such a winding, when connected to a suitable full-wave valve rectifier, gives a rectified and smoothed output of about 350 volts. That does not mean that there has been no loss in the rectifier; actually the transformer *peak* voltage rises to 500, and it is just a convenient coincidence that the DC output on full load is about the same as the transformer RMS voltage. On full load, note. Some thought must be exercised when the current to be drawn from the power unit differs from that which the team of components is designed to supply. Transformer, rectifier, and chokes all hold back a number of volts depending on the current flowing; and it is usual to show how many by means of a " Regulation curve." When deriving information from these, one must take care to ascertain exactly how much of the equipment is included. The most useful curve, evidently, is one which includes all the components; but as they are bought from quite different firms it is not easy to get hold of such information.



Typical smoothing chokes, on the left a Wearite, with a Sound Sales model on the right and a Bulgin component in the centre.

The Westinghouse Co. gives inclusive data, assuming certain specified chokes and transformers. But the valve maker's curves (which, incidentally, are practically straight lines) take no account of transformer or chokes. It is easy enough to calculate how many volts are lost in the chokes by multiplying their resistance by the *actual* current in them (in amps). The result is generally not more than 10 or 20. The transformer resistance may not be known, and in any case it is no simple matter to reckon how much current actually flows in it. With reasonable transformers one is not likely to be very wide of the mark in assuming that the voltage on no load is 12 per cent. higher than at full rated load, and *pro rata*.

If the current taken by the receiver is much less than that for which the power unit is rated it may be necessary to drop the surplus volts in a resistor, which can be connected in series with the smoothing choke. But it must be remembered that the voltage then depends even more steeply on the current.

Some transformer LT windings are provided with centre-taps for connecting earth returns or positive leads. This custom is tending to fall out of use, and there is usually little to be said against making the connections to one or other of the two LT outer terminals. But there is one exception: directly heated output valves. There is no need, apart from convenience, to have transformer centre-taps even then. In fact, there is some advantage in using one of the semi-adjustable anti-hum potential-dividers sold for the purpose (Fig. 3). When only one directly heated output valve is used, it is possible to arrange to run it from the same LT winding as the other valves, and at the same time to get automatic grid bias; but in such cases it is more usual to get the bias from the voltage drop in the loud speaker field connected in the negative line. In a home-built set it is perhaps better to select a transformer with a separate winding for the output valve. And if there are to be two directly heated valves in push-pull, two extra windings are essential.

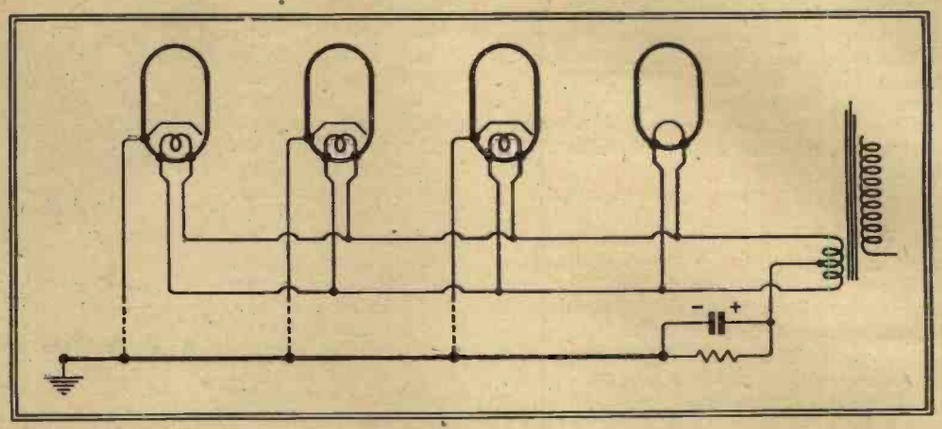


Fig. 4.—Automatic grid bias for a directly heated valve can be provided without needing a separate LT winding.

When selecting a transformer or choke, it is worth while taking some care to see that the stampings are thoroughly tightened up everywhere. It is extremely trying when one goes to great lengths to cure a hum assumed to be emitted by the loud-speaker, and then finds that it is really the transformer core that is making the noise. If screwing up the clamps fails to stop this annoyance, some thick varnish run well into the core is a certain cure.

In the early days of power from the mains, grid bias used to be a worry to designers. But now the bias is really part of the receiver proper, and " automatic " bias is almost universal. And there is now little question that the best way of decoupling is by means of a condenser connected straight across it; about 0.1 mfd. for HF circuits, and 25 mfd. or 50 mfd. for LF.

The latter, of course, are electrolytic; and one must not forget to connect the *positive* terminal to the cathode. The voltage rating need not be more than slightly above the actual grid bias voltage.

In DC or universal sets, in which the heaters of all the valves are connected in series, there is usually a proportion of the mains voltage not absorbed in this way. Special types of resistors are made for this purpose, and as the heat given off may be considerable there must be adequate ventilation; to say nothing about protection from shock. As an alternative the barretter deserves serious consideration. It has never been so popular in this country as on the Continent, but apart from providing a very convenient form of resistor it has the great advantage that it keeps the current constant at the correct amount between wide limits of voltage. Fig. 5 is a characteristic curve of the Philips C1, which is suitable for the standard Universal valves.

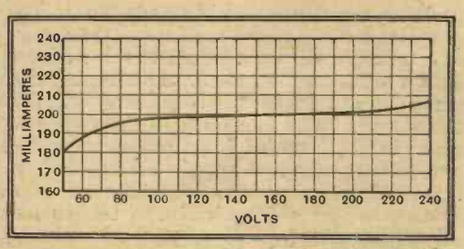
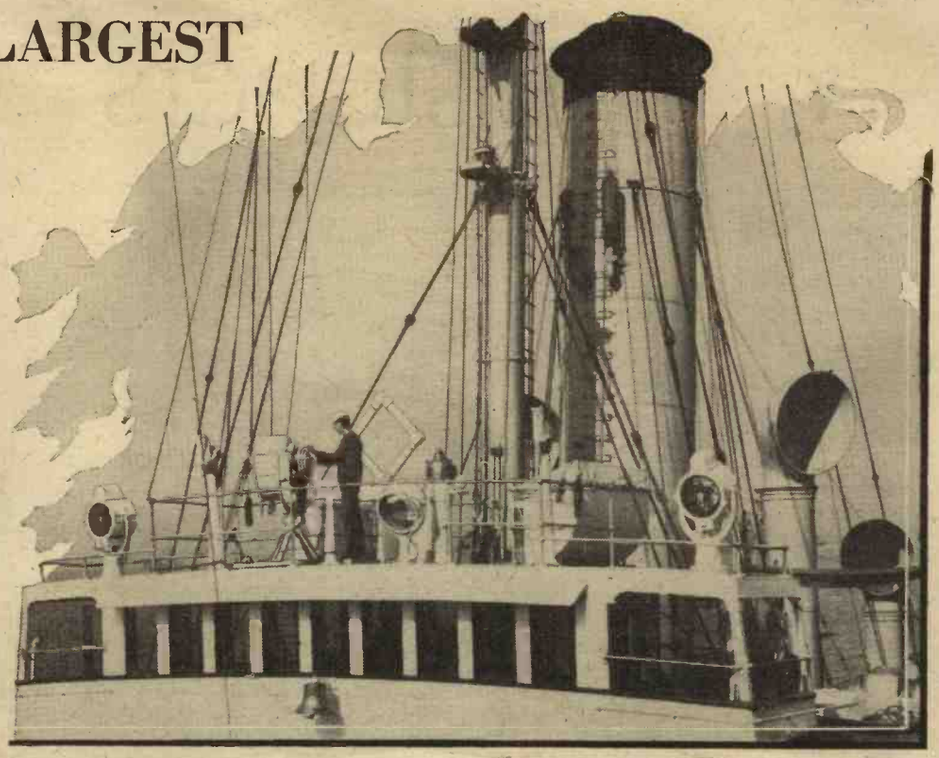


Fig. 5.—An appropriate barretter keeps the heater current for universal or DC valves at the correct value over a wide range of mains voltages.

THE WORLD'S LARGEST SPEAKER

500-watt Voice to Drown Ocean's Roar



The speaker, seen on the upper deck, can be rotated in any direction required.

A LOUD speaker delivering 500 watts of energy is not misnamed. Such is the instrument recently developed by engineers of the Bell Telephone Laboratories of the Western Electric Co., Pittsburgh, U.S.A. It follows the general principles of those used in talking pictures and public address systems, but, being designed expressly for speech purposes, contains certain unique features for increasing its penetration and intelligibility in the presence of other sounds.

Narrow Frequency Band

This is accomplished by sacrificing naturalness of reproduction and concentrating the maximum energy into the voice-frequency range. Whereas a 40 to 10,000-cycle range is expected of a good musical reproducer, the new speaker concentrates its power into the band of from 400 to 4,000 cycles.

An officer makes an announcement from the bridge of the cutter *Tampa*.

The amplifier and moving-coil microphone are also designed to cover this limited frequency band.

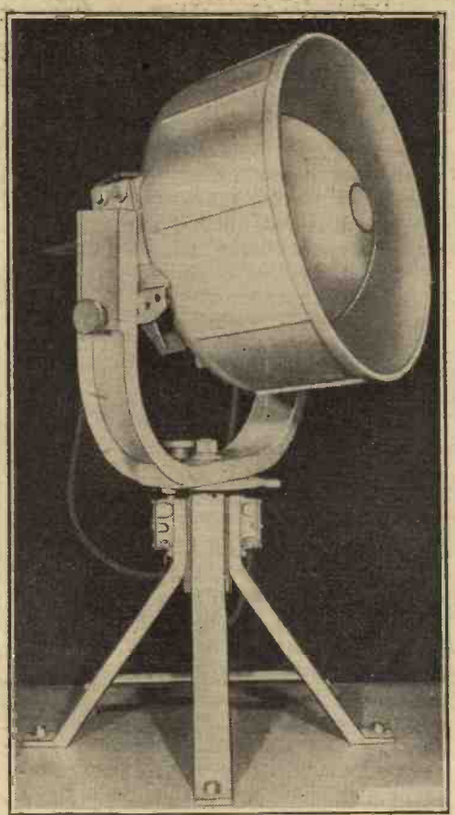
The speaker diaphragm is made of duralumin, 0.01 of an inch thick, travelling no more than 0.025 of an inch in either direction. When so moving it provides a sound pressure of about one pound per square inch. The mechanical force required to set up this pressure is about 50 lb. The amplifier can deliver 1,000 watts of speech current.

The speaker and horn combined are 30 inches in diameter by 30 inches deep, the horn being of the folder type and made of cast aluminium.

The purpose of this outsize in public address systems is two-fold: first, to cover a long range, and, secondly, to shout down other noises. Firemen within burning buildings and deafened by the crackle of flames could be directed by the speaker, which would also be invaluable for giving instructions to shipwrecked crews during storms at sea. It would also be an admirable substitute for a fog-horn.

The speaker and horn are mounted on a swivel mast and can be pointed in any direction. The entire system is controlled at the microphone by a single push-button which, through a series of relays, performs all the various operations necessary to start up or shut off the amplifier.

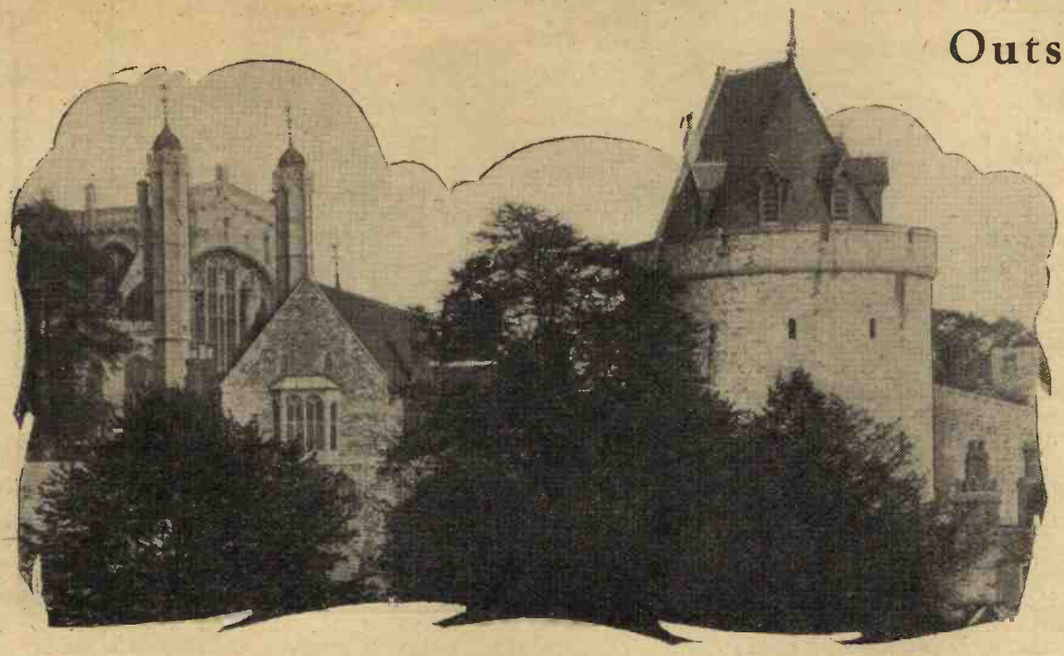
Its most recent use was on the coastguard cutter *Tampa* at the international yacht races between *Enterprise* and *Endeavour* at Newport, R.I. The giant speaker was invaluable for policing the course.



The new 500-watt speaker closely resembles a searchlight.

★ ★ Listeners' Guide for

Outstanding Broadcasts



On Christmas morning a service will be broadcast at 10.45 from St. George's Chapel, Windsor. In our photograph the chapel can be seen on the left. On the right is the famous Curfew tower.

TRADITION.

ALREADY broadcasting is becoming encrusted with tradition, and this is never more apparent than at Christmas time. There are items in the Christmas programmes which we have come to look for, and to be deprived of them would mean real disappointment.

The world-wide broadcast on Christmas afternoon, call it "Empire Exchange" or what you will, is becoming an institution—in fact a Royal institution—for His Majesty's speech crowns the whole.

Christmas Eve, too, now has its regular features, notably the carols broadcast from King's College, Cambridge, in the afternoon and those from St. Mary's, Whitechapel, at night.

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EMPIRE EXCHANGE.

THE Christmas Day programmes begin with a morning service at 10.45 from St. George's Chapel, Windsor, and thereafter until midnight the National transmitters will pour out a continual flow of music and entertainment.

"Empire Exchange," which begins at 1.55 p.m., will put a girdle round the earth. Voices from near and far—from lonely outposts as well as the humming cities of the Empire—will give us a picture in sound against a background of bells, beginning at the Church of the Holy Sepulchre, Bethlehem, and resounding throughout India, New Zealand, Canada and Ireland.

An attempt will be made to conclude the programme with the singing and playing of the National Anthem in a novel way. The Anthem will begin quietly with a few singers in a Warwickshire village, will then be taken up in Central Africa, Australia and Canada, concluding with a choir, military band and organ performing the last verse in the concert hall at Broadcasting House, London.

At 3 o'clock His Majesty the King, seated at his study desk at Sandringham, will give his annual message to the Empire.

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"THE MESSIAH."

STILES ALLEN (soprano), Margaret Balfour (contralto), Tom Pickering (tenor), and Keith Falkner (bass) are the soloists in Part 1 of Handel's "Messiah" which is to be broadcast on Sunday evening at 9.30 (National) with B.B.C. Chorus and Orchestra, conducted by Adrian Boult.

THE CHRISTMAS PARTY.

To get the effect of spontaneity in the broadcast studio usually requires perfect organisation and very little real spontaneous effort. On Christmas night, however, John Watt will go all out to help us share a genuine Christmas party in the studio. Old-time Christmas songs will be faded out to "general party dialogue," and then will follow musical chairs, Mabel Constanduros in a Christmas sketch and Henry Hall waiting round the corner with his Boys to burst in at the slightest provocation. Then as A. J. Alan leaves the world laughing with a pungent Christmas story, Freddie Grisewood will bring in "Old Bill." Later there will be a Christmas charade, and, after a Surprise Item, "Auld Lang Syne" will end the party.

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SNAPPINESS FROM DENMARK.

THE Danish dance bands are among the "snappiest" on this side of the Atlantic, and as many long-distance listeners know, often sing their refrains in English. Between 3 and 4 p.m. on Boxing Day, London Regional is taking a relay from Denmark of Louis Preil and His Broadcasting Dance Orchestra in Copenhagen. The repertoire is a nice blend of English and American.

All thoughts will be turned to Bethlehem on Christmas afternoon when the bells of the Church of the Holy Sepulchre will start a peal which will resound round the Empire. The picture shows the little town in winter.

the Week

at Home and Abroad

CHRISTMAS IN EUROPE

THE European stations offer a happy collection of Christmas features. Among the most picturesque is the Vienna programme, "Christmas in an Alpine Village," to be broadcast at 6.10 on Sunday evening next. One of the most impressive should be the transmission from Leipzig and Stuttgart at 7 p.m. on Monday. This will include the bells of no fewer than thirty churches scattered up and down the country. An hour later all German stations will relay a Christmas address by Herr Hitler's deputy, Rudolf Hess, to German seafarers and those living abroad.

At 10.50 on Christmas Eve Stuttgart will broadcast a Christmas Mass from the Beuron Monastery.

France will make merry with dance music, beginning at eleven on Christmas Eve and continuing until 2 o'clock on Christmas morning. Poste Parisien and Radio-Toulouse will both be transmitting up to this hour.

PANTOMIME.

No Boxing Day would be complete without its pantomime. This year Gordon McConnell is producing "Bluebeard," to be broadcast on the National wavelength at 7.30. It will be repeated Regionally at 8.45 p.m. on Thursday, December 27th. The part of Bluebeard (a much married millionaire) is to be taken by Dick Francis. There is to be a chorus of Bluebeard's elderly wives. Wynne Ajello plays "Fatima," the perplexed heroine.

THE PARADE COMES BACK.

"THE RIDGEWAY PARADE" really does parade, but after perambulating the country it will come to rest at 8.30 this evening with a broadcast from London Regional. This much-talked-of show is a vigorous affair and always sets the milliameter needles oscillating at maximum amplitude. The Parade is to be repeated at 4.15 to-morrow afternoon (Saturday) on the National wavelengths.

THE "ELIA" CENTENARY.

WE can forgive the B.B.C. for sparing only quarter of an

HIER LEIPSIC! Fraulein Hilde Schmeck, who has completed a probationary period at the Leipzig microphone and is now a fully fledged announcer.

hour in commemorating the centenary of the death of Charles Lamb. "Elia" never disguised his dislike of music, and it is therefore inconceivable that he would have approved of 80 per cent. of the B.B.C. programmes. However, the beloved essayist will have a staunch champion in Desmond MacCarthy, who will give a Lamb reading, with notes, at 10.15 p.m. on Thursday next (National).

"OLIVER TWIST."

"OLIVER TWIST" is so rich in character studies that it would be extremely difficult to achieve complete failure in a broadcast version. Thursday's broadcast (National, 7.30) promises to be an excellent performance. Desmond Tester, who takes the part of the hero, is a schoolboy who emerged triumphantly from an audition at Broadcasting House. He will be supported by Matthew Bolton as Bill Sikes, Barbara Couper as Nancy, and Harcourt Williams as Fagin. The Artful Dodger will be taken by Frederick Peisley.

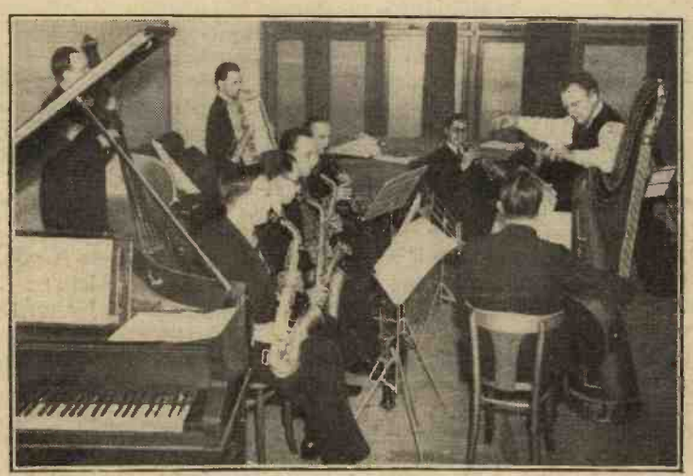
This production of one of the best known novels of all time is by J. Comyns Carr, and has been revised for broadcasting by Howard Rose.

If, as I believe, "Oliver Twist" proves a microphone success, several other Dickens works may be broadcast.

YOUR OWN PREFERENCE.

VERY many thanks to all those readers who responded to my appeal for postcards indicating programme preferences. So far the voting is definitely in favour of uninterrupted orchestral programmes, preferably of large combinations, playing well-known classics in the manner of the German stations. Opera is a close second, and next to it come operettas. Then come pianoforte and organ recitals, and dance music requests are next.

If you feel that this voting is not representative there is still time to register the order of your preferences (1, 2, and 3). Please mark them on a postcard and address it to

THE AUDITOR.

The Cafe Colette Orchestra in Monday morning garb. This picture was taken during a rehearsal, with Walford Hyden conducting. The orchestra will be heard on the Regional wavelengths at 8 p.m. on Thursday next.

HIGHLIGHTS OF THE WEEK

FRIDAY, DEC. 21st.

Nat., 8.30, "The Little Boy," play for broadcasting by E. M. Delafield.
London Reg., 8.20, "The Ridgeway Parade." 9.20, Opera: "Eugene Onegin" (Tchaikowsky), Act II, from the Old Vic.
Abroad.
Luxembourg, 8.45, Gala Concert by the Station Orchestra.

SATURDAY, DEC. 22nd.

Nat., 4.15, "The Ridgeway Parade." 5.15, Ambrose and His Orchestra. 8.30, "Music Hall."
London Reg., 8, "The Little Boy."
Abroad.
Breslau, 7.10, Opera: "Martha" (Flotow).

SUNDAY, DEC. 23rd.

Nat., 12.30, Christmas Concert by the Western Studio Orchestra. 9.30, "The Messiah," Part I, with soloists, B.B.C. Chorus and Orchestra.
London Reg., 4.30, London Symphony Orchestra, conducted by Sir Hamilton Harty.
Abroad.
Vienna, 6.10, "Christmas in an Alpine Village."

MONDAY, DEC. 24th.

Nat., 8, Entertainment Hour, including Stainless Stephen's Pantomime. 9, Carols from St. Mary's, Whitechapel.
London Reg., 5.15, Mabel Constanduros and Michael Hogan in Children's Christmas Party. 7.45, B.B.C. Orchestra (Section D) conducted by Joseph Lewis.
Abroad.
Leipzig and Stuttgart, 7, Christmas Bells from thirty churches.

TUESDAY, DEC. 25th.

Nat., 1.55, "Empire Exchange." 3, Message from H.M. The King. 7.30, Christmas Party. 9.30, News. 11, Dancing.
London Reg., 3.15, Torquay Municipal Orchestra. 6.45, (and Mid. Reg.) "All at Sea" with the Melluish Brothers. 7.30, B.B.C. Orchestra (Section E). 8.45, "The Christmas Journey"—a Masque of the Nativity.
Abroad.
Warsaw, 8, "The Christmas Songs of Europe."

WEDNESDAY, DEC. 26th.

Nat., 7.30, "Bluebeard" — a mythical musical melofarce.
London Reg., 6.30, Henry Hall and the B.B.C. Dance Orchestra. 7.45, B.B.C. Orchestra (Section D) conducted by Frank Bridge. Soloist: Joseph Farrington (bass). 9, The Kentucky Minstrels.
Abroad.
Frankfurt, 8.10, "The Magic Violin"—a fairy tale drama.

THURSDAY, DEC. 27th.

Nat., 7.30, "Oliver Twist." 9, Recital by Dale Smith (baritone).
London Reg., 7.15, Wireless Military Band and Ronald Gourley (entertainer at the piano). 8, The Café Colette Orchestra. 8.45, "Bluebeard."
Abroad.
Radio-Paris, 10.30, Symphony Concert.

UNBIASED

By FREE GRID

The New Film-Plugging

I HEAR from an unusually reliable source that strong pressure is being brought to bear on the powers-that-be to get them to relax the rule which forbids a radio relay exchange to put out programmes other than those received by wireless.

As many people know, these relays churn out, for the benefit of their clients, the B.B.C. and various Continental programmes, but they are forbidden to keep their own tame soprano to warble at times when nothing worth listening to is coming in via the ether. Similarly, they are forbidden to relay concerts from the Parish Hall or similar night haunts.

Their own tame soprano.

The people behind the new move to get this rule relaxed are the cinema folk, who want to feed music direct from the sound track of the films to the lines of their local relay service. This procedure would, of course, be done during the normal times that the films were being shown, and would not in any way affect the ordinary programmes, as a tapping would merely be taken off the ordinary talkie amplifier.

The great idea behind the proposal is, it seems to me, advertising, by making use of the relay system for "film-plugging." The cinema magnates would argue that once the public appetite has been whetted by hearing the music of the film, they would want to see it, and would accordingly trot along at the earliest opportunity. I suppose, in addition, a microphone would be provided for giving excerpts from the wretched organ when it was in action, thus providing yet another horror in our lives.

It is, of course, up to those who patronise the relay services to say whether they want this sort of thing or not, but, personally speaking, I should strongly object to it, as there would be no way of escape to other stations, as there would be if it were coming in by wireless. I see no objection, however, to permitting the cinemas to install small transmitters on their roofs with just sufficient power to cover the locality they served. They could then dish up their excerpts via this medium, while the power would be sufficiently low to enable even the most unselective set to be tuned to better things without being swamped out. It is, I think, a very good method of giving practical application to ultra-short waves with their "optical" range, and would afford many people an introduction to the technique of microwaves in readiness for the coming of television.

A Sartorial Hint

THE B.B.C., I am glad to see, are once more turning their attention to the growing slackness concerning matters of dress among those who appear before the microphone. It is, I understand, a definite rule that full evening dress is *de rigueur* save for those who are taking character parts.

It is high time, I think, that some similar disciplinary action was taken in the case of listeners. The regrettable habit of listening in pyjamas and bedroom slippers is becoming far too prevalent. Apart from questions of manners and etiquette, listeners ought to realise how much more enjoyment is to be extracted from listening by donning the garb appropriate to the programme of the moment. For a long time now I have insisted that my family should clothe themselves suitably when listening.

It might be thought that evening dress would meet all eventualities, but this is by no means the case. You would not, for instance, don this garb if going to the races or to a football match. At a recent talk on foxhounds I found that hunting pink materially enhanced my appreciation of the item, while a hasty scramble into bathing slips enabled me to enjoy in full measure a talk on swimming which followed immediately afterwards. I must confess, however, that I was in somewhat of a quandary the other night when the "Snow Maiden" was broadcast. I had no difficulty in manufacturing some snow with the aid of the family refrigerator, but both myself and the room were in a sorry mess before the opera was over. I was certainly in no condition to appreciate the efforts of a gentleman who followed with a talk on the delights of winter sports.

From the Back Row?

JUDGING from the vehemence and the volume of correspondence received concerning my revelations of *sub rosa* love-making in the cinema (new readers, *vide The Wireless World* for November 23rd), I appear to have fallen into a grievous error, or, to put it in the language of the vulgar for your benefit, to have dropped a brick.

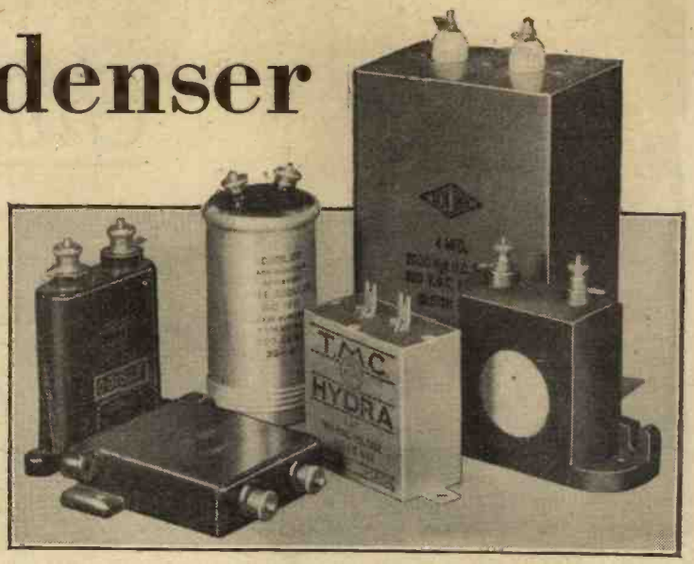
I have received letters, and even telegrams, both from representatives of the cinema industry and members of the picture-going public. The former strongly resent my implied suggestion that film producers are so slack in their staff-disciplinary measures, and so lacking in solicitude for the comfort of their patrons, that they permit unofficial love-making to be indulged in by members of the cast. The latter, on the other hand, while under no illusions concerning the ethics of the average cinema crowd, hasten to point out that in this case the voices which I heard in my super-sensitive deaf-aid undoubtedly emanated from the back row of the audience.

Amateurish attempts to imitate.

It would appear, by my correspondents' letters, that this portion of the cinema is, by tacit and universal consent, reserved for those members of the public who aspire to be film stars and desire to practise the technique. The back seats are chosen presumably because there are no unkind persons sitting behind who might seek to pour ridicule on their crude and amateurish attempts to imitate the great masters of the art that they see on the screen before them.

The Fixed Condenser

The Evolution and Characteristics of Modern Types



Group of baseboard-mounting condensers showing Dubilier ; T.C.C. ; T.M.C. Hydra ; Lissen and Sound Sales models.

A CONDENSER is such a commonplace article to-day, and obtainable in so many different forms, that its gradual evolution from the earliest type of Leyden-jar has become obscured by the passage of time. The Leyden-jar would seem a cumbersome thing these days, for it consisted of a large glass container coated on the outside and on the inside with electrolytically deposited copper; these films formed the plates, and the glass walls of the container the dielectric. One jar was the practical standard of capacity, it being equal to 1-900th or 0.0011 mfd.; actually its capacity was 1,000 cms. Long before the inauguration of broadcasting fixed condensers were becoming more compact, the present-day practice of thin sheets of metal foil interleaved with mica taking the place of the old style of jars. For large capacities paper replaced the mica, for it enabled condensers to be made in easily handled sizes, though this style would not, in the early days, stand up to high voltage, but they were quite satisfactory for use in receivers of the period, since it was the exception rather than the rule to employ more than 100 volts.

Modern small-capacity condensers are usually fitted with wire ends for suspending in the wiring.

The meanest paper-dielectric condenser now obtainable can be operated at voltages of the order of 250 DC, while models are made to withstand 1,000 volts continuous working, the margin of safety being such that even 2,000 volts will not puncture the dielectric if applied for short periods only.

For receiver use many different styles are now available; some have mica as the dielectric, others thin waxed paper, while a comparatively new development is the electrolytic pattern.

Where small capacities are required, such as in high-frequency circuits, it is customary to fit mica condensers, for in these sizes their prices are very reasonable. Paper condensers find favour in LF circuits where capacities greater than about 0.01 mfd. are required, in anode de-coupling circuits, for it is now possible to obtain this style constructed on a non-inductive principle, also for smoothing the HT supply when derived from the electric mains.

As there is an appreciable leakage in the electrolytic condenser, its use is mainly reserved for such functions as HT smoothing and for shunting grid bias resistors, as the leakage is then of little consequence, being equivalent to joining a resistance of some megohms in parallel with the condenser.

In grid bias de-coupling circuits capacities of from 25 to 50 mfds. are quite common, and the electrolytic pattern is the only style that will give this capacity in a compact form. The "dry" form of construction is adopted for this pattern, and it is generally assembled in a cylindrical bakelised tube with wire ends. Fundamentally, the wet and the dry pattern are the same, and they differ only in the form of construction. When certain metals, such as aluminium, magnesium and tantalum, are immersed in certain chemical solutions they allow current to flow in one direction but not in the other, and the basic principle is similar to that of a chemical rectifier, though the construction of an electrolytic condenser does not allow of its being used for this purpose.

Aluminium electrodes are usually employed, the electrolyte being a free liquid in the wet type, but held in suspension by an absorbent material in the dry style. As electrolytic condensers are polarised it is essential that they be connected in the right manner, for reversing the polarity may cause irreparable damage. Several makers assemble them in tubular aluminium cases designed for mounting on a metal chassis, the case is usually negative, and the positive connection is brought out through an insulated bush in the base. Others favour a waxed cardboard container, and in this pattern connection is made by two or more insulated leads, for there are some models consisting of two separate condensers in the one container. A quite recent development is the reversible type designed primarily for use in universal and DC sets. This condenser is not damaged by reversal of polarity and so acts as a safeguard for the components in the set should the mains plug be inserted into the DC point the wrong way round. Nevertheless, it is not suitable for use on raw AC. A good general rule is that electrolytics are essentially for DC conditions, whilst for all AC circuits either the paper or mica dielectric models should be employed. They are, of course equally suitable for DC work.

(C) Typical modern electrolytic condensers comprising Ferranti ; Bulgin ; Peak ; T.C.C. ; Dubilier and Polar-N.S.F. models. The small tubular types are for grid bias de-coupling circuits.

The Wireless World

Guide to Receivers III.

(Concluded from page 505 of December 14th issue.)

Inexpensive Sets of Every Type

EXCEPT where stated to the contrary, readers are asked to assume that the receivers here described are table models, designed to operate with an external aerial. Power rectifying valves, and metal rectifiers (power or HF) are not included in the number of valves, and so our rating will in some cases differ from that of the maker.

RECEIVERS : 10 GUINEAS and BELOW

Pentodes in All Stages

AERODYNE "DRAKE" 10 gns.
Three-valve "Straight" Receiver for AC Mains

Pentode valves are used throughout and the HF valve is of the variable-mu type. It is preceded by a band-pass filter in which a combination of high and low potential capacity coupling is employed. A mains aerial connection is provided and there are terminals for a low-resistance external loud speaker.

Unusual Filter Coupling

AERODYNE "BLACKBIRD" 10 gns.
Four-valve "Straight" Battery Receiver

Designed on essentially the same lines as the AC mains "Drake" receiver, the circuit includes the same type of coupling in the band-pass filter but a triode detector valve is employed and the additional valve is a driver preceding the Class "B" output stage. A semi-circular tuning scale is used and the vertical cabinet is designed to house the batteries.

Time and Wireless

AERODYNE "MERLIN" 9 gns.
Three-valve "Straight" Battery Receiver

The HF and detector stages are similar in design to those of the "Blackbird" receiver, but a single pentode valve is used in the output stage. A "clock face" tuning dial is employed, and this is matched on the right-hand side of the control knob by a chromium-finished clock.

Two-valve Mains Set

AERODYNE "ROBIN" 7 gns.
Two-valve "Straight" Receiver for AC Mains

The circuit of this receiver is a simple detector-LF arrangement in which pentode valves are employed in both stages. The output pentode is capable of delivering three watts and the loud speaker is of the energised type. A simple coupled-aerial tuner with reaction is employed, and there are three degrees of selectivity. The tuning dial is of the "clock face" type and is illuminated.

Clock Face Tuning Dial

AERODYNE "WREN" 7 gns.
Three-valve "Straight" Battery Receiver

Unlike the "Blackbird" and "Merlin" receivers this set does not include a band-pass input, but the aerial circuit includes alternative series condensers to give adequate selectivity. Both the detector and output valves are triodes. The cabinet is of the horizontal type, and a permanent magnet moving-coil loud speaker is included in the specification.

Incorporating a Clock

AERODYNE "RAVEN" 5 gns.
Three-valve "Straight" Battery Receiver

The circuit is of the det.-LF type with a single tuned input circuit and two stages of LF amplification. The cabinet is available in a black ebonised finish with chromium fittings, or in oak with brown bakelite fittings. A clock is included in the specification.

Aerodyne Radio, Ltd., Aerodyne Works, Walthamstow, London, E.17.

A Battery Transportable

BEETHOVEN MODEL 54 9½ gns.
Four-valve "Straight" Battery Receiver

The circuit consists of a variable-mu HF pentode followed by a detector, LF amplifier and output pentode. The receiver is entirely self-contained with frame aerials, batteries and moving-coil loud speaker, and the cabinet is mounted on a ball-bearing turntable.

Local or Distant Reception

BEETHOVEN MODEL 53 £7 19s. 6d.
Three-valve "Straight" Battery Receiver

Designed for use with an external aerial, the circuit of this receiver is similar to that of the Model 54, but the first LF stage is omitted. The volume control is supplemented by a "Local Distance" sensitivity switch, and the volume control is operative both on radio and gramophone. The cabinet work, in the modern style, is of walnut relieved by lighter bird's-eye maple.

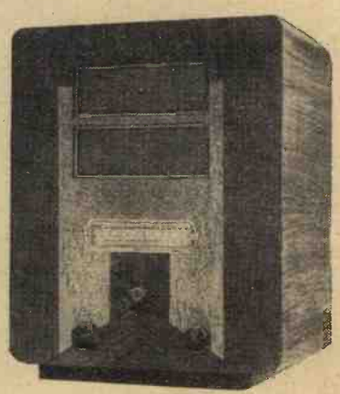
De Luxe Suitcase Portable

BEETHOVEN MODEL P85 9½ gns.
Four-valve "Straight" Battery Receiver

Every effort has been made to ensure that this set shall be the last word in suitcase portable design. A permanent magnet moving-coil loud speaker is included, and the tuning dial incorporates a travelling spot-light indicator. The circuit is similar to that of the Model No. 54 transportable.

A simplified version known as the SG4 Minor, with a moving-iron loud speaker and a simplified form of tuning indicator, is available at £7 10s.

Beethoven Radio, Ltd., Great College Street, Camden Town, London, N.W.1.



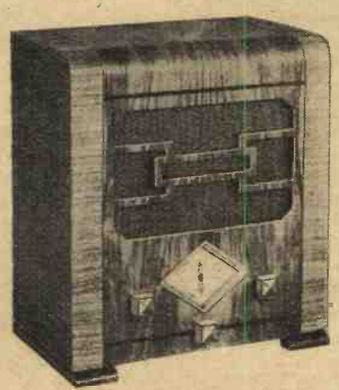
Beethoven Model 54, and (left) the Beethoven Major portable.

Inexpensive Battery Superhet

BURGOYNE SUPERHETERODYNE 10 gns.
Five-valve Battery-fed Superheterodyne

This, the most ambitious of the Burgoyne series of low-priced receivers, has quite an impressive specification, including band-pass tuning in both signal-frequency and IF circuits. The latest type of biased Class "B" output stage feeds a moving-coil speaker.

Burgoyne suitcase portable.



Burgoyne 2-P Comet

RECEIVERS: 10 GNS. AND BELOW (Continued)

Dual Speakers

BURGOYNE CLASS "B" DE LUXE £7 9s. 6d.
Three-valve det.-LF Battery-fed Receiver (Class "B" Three, £6 10s. 0d.)

An unusual variant of the conventional detector-LF receiver, in which a Class "B" output stage feeds a pair of moving-coil speakers. A driver valve is interposed between the detector and output stages.

The chassis and pair of speakers are neatly mounted in a cabinet of the horizontal type. A simpler version is fitted with a single speaker.

A Suitable Portable

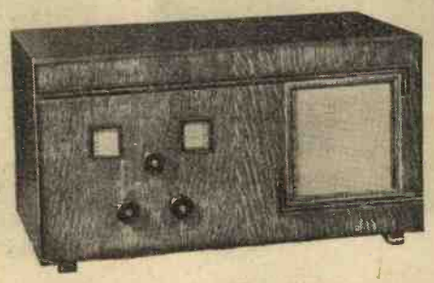
BURGOYNE SCREENED GRID IV. PORTABLE £6 17s. 6d.
Four-valve Battery-fed Portable with Built-in Frame Aerial

An example of the HF-det.-2LF circuit, so widely used in self-contained receivers. A screened pentode acts as an HF amplifier; the tuning scale is calibrated in wavelengths.

The receiver measures 12½in. × 14in. × 10in. when closed.

Cossor Model 435, and (left) the Cossor Model 350.

(Right) Climax Model S5H.



HF and Output Pentodes

BURGOYNE 2-P COMET 6 gns.
Three-valve Battery-fed Receiver. (Similar Model, Two-Pen-Three, £5 17s. 6d.)

An HF-det.-LF circuit with pentodes in both HF and output positions is used in this model. Like all other Burgoyne sets, it is supplied complete with HT and LT batteries at the price given.

Trouble-free Circuits

BURGOYNE OLYMPIC DE LUXE 5 gns.
Three-valve Battery-fed Receiver (Olympic, 3, 4 gns.)

The det.-2LF type of circuit, as embodied in this receiver, has staged a distinct "come-back" this season, partly because it is extremely reliable and unlikely to develop faults.

A moving-coil speaker, fed by a pentode, is fitted to this model, while a cheaper version employs a moving-iron instrument fed by a triode.

Burgoyne Wireless (1930), *Ltd., Great West Road, Brentford, Middlesex.*

"General-purpose" Circuit

BURTON THREE-VALVE SPECIAL 9 gns.
Three-valve Receiver for AC Mains

Up-to-date practice in straight-circuit design is followed in the chassis of this model, which includes an HF stage followed by a power-grid detector and pentode output rated at 2 watts. A special selectivity control is provided for use where receiving conditions are difficult.

Simple but Practical

BURTON AC2 £7 15s. 0d.
Two-valve Receiver for AC Mains

Where requirements as to selectivity and range are not exacting, the straightforward detector-LF 2-valve circuit provides a practical and dependable receiver, eminently suited for local-station or medium-distance work. As this is an AC model, employing indirectly-heated valves of high efficiency, it should be capable of satisfying all reasonable expectations at a very moderate price, and may be expected to be largely immune from breakdowns.

Burton three-valve AC mains model.

Class "B" Battery Set

BURTON FOUR-VALVE SG £7 10s. 0d.
Four-valve Battery-fed Receiver

The valves of this set are arranged as HF amplifier, detector, driver and output, the latter being of the Class "B" type, feeding a moving-coil speaker. The chassis is housed in a plain but neat and workmanlike cabinet.

C. F. & H. Burton, Progress Works, Bernard Street, Walsall.

Spectrum Tuning

CLARKES ATLAS 3-4-5 £7 10s.
Three-valve "Straight" Battery Receiver

Housed in a two-colour walnut cabinet with chromium fittings, this receiver, although simple in circuit design, incorporates the Atlas system of tilting spectrum tuning dial. Iron-cored tuning coils are employed and the loud speaker is of the permanent magnet moving coil type.

H. Clarke & Co., (Manchester), Ltd., Atlas Works, Patricroft, Manchester.

Standard Superhet Circuit

CLIMAX MODEL S5 10 gns.
Four-valve Superheterodyne for AC Mains

This receiver has been slightly modified since it was described in *The Wireless World*, and now embodies band-pass tuning, an octode frequency changer, and an output pentode rated at 3 watts. Proper provision is made for switching off the internal loud speaker when an external instrument is in use.

HF-det.-LF Battery Set

CLIMAX MODEL BH3 (Without Batteries) £6 17s. 6d.
Three-valve Battery-fed Receiver

A straightforward "one-HF" circuit with pentode output is embodied in this receiver, which is fitted with a moving-coil speaker.

Det.-LF Circuit

CLIMAX MODEL B3MC £5 15s. 0d.
Three-valve Battery-fed Receiver

A circuit arrangement embodying a grid detector followed by two stages of low-frequency amplification is used in this model. A cheaper set, fitted with moving-iron speaker but otherwise similar, costs £4 12s. 6d.

Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

Iron-Cored Coils

COSSOR MODEL 435A £9 15s. 0d.
Three-valve Receiver for AC Mains

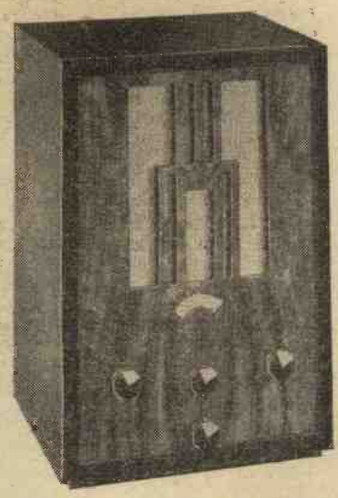
This, the most ambitious of the Cossor "straight" receivers, includes iron-cored tuning coils, a screened HF pentode as a detector, and a pentode output valve. The HF valve is of the variable-mu type, and a continuously variable selectivity control is fitted.

Class "B" Battery Set

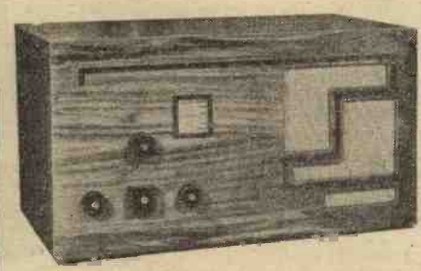
COSSOR MODEL 435B £8 15s. 0d.
Four-valve Battery-fed Receiver

This may be regarded as a battery counterpart of the 435A; it includes the same features of iron-cored tuning coils and pentode detection, but, with an eye to economy in upkeep, the Class "B" system has been adopted for the output circuit. The loud speaker is of the moving-coil type with an 8in. diaphragm.

All prices of Cossor battery sets are exclusive of batteries.



Climax det.-LF battery set, and (below) the HF-det.-LF model.



DC Console Receiver

COSSOR MODEL 3469 £9 15s. 0d.
Three-valve Receiver for DC Mains only, in Console Cabinet

A "straight" circuit, with variable-mu HF valve followed by triodes in the detector and output stages, has been chosen for this, the only Cossor DC receiver. The cabinet is of the upright type, and requires very little floor space.

AC Mains and Battery Models

COSSOR MODEL 358 £8 15s. 0d.
Three-valve Receiver for AC Mains. (Battery Model 353, £6 17s. 6d., or, in Console Cabinet, £8 15s. 0d.)

This is a slightly less ambitious version of the Model 435A receiver described above, but it embodies several of its special features, including iron-cored coils and a screened-pentode detector.

The battery equivalent is fitted with an "economy" pentode in place of the Class "B" amplification of Model 435B.

Low-priced "HF" Set

COSSOR MODEL 350 £5 12s. 6d.
Three-valve Battery-fed Receiver

This, the lowest-priced Cossor set, embodies a straight HF-det.-LF circuit with triode detector and output valves and a moving-iron speaker. Even in this inexpensive model, however, the coils are of the iron-cored type.

A. C. Cossor, Ltd., Cossor Works, Highbury Grove, London, N.5.

RECEIVERS: 10 GNS. AND BELOW (*Continued*)

Inexpensive Battery Superhet

DRUMMER MODEL B44 10 gns.
Four-valve Battery Superheterodyne

Although this receiver is distinctly low in price, the technical specification is by no means devoid of interest. Iron-cored coils are employed in both HF and IF circuits, while "mains set" practice is followed in the diode second detector and AVC circuits. A pentode output valve feeds a moving-coil loud speaker.

"Straight" Battery Set

DRUMMER MODEL B3 7½ gns.
Three-valve Battery-fed Receiver

An HF stage, triode detector, and pentode output valve are included in this receiver, which is fitted with a moving-coil speaker.

Edge Radio, Ltd., Bolton, Lancs.

Improved Station Dial

EKCO MODEL B54 10 gns.
Four-valve Battery-fed Receiver

Class "B" output, preceded by driver, detector, and one HF stage, make up the basic circuit arrangement of the latest Ekco battery set. Externally, the instrument is a typical Ekco production, and is housed in a moulded bakelite cabinet; the controls are well arranged, and the station-name scale is exceptionally clear and legible.

E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex.

A Simple Universal Set

G.E.C. AC/DC MAINS THREE £7 15s. 0d.
Two-valve Universal Mains Receiver

Housed in a handsome moulded bakelite cabinet, this receiver is capable of a power output of 2 watts. The simple det.-LF circuit employs universal valves, and, in addition to the power rectifier, a barretter is included to compensate for variations in mains voltage.

Mains Performance from Batteries

G.E.C. BATTERY CB4 £9 17s. 6d.
Four-valve "Straight" Battery Receiver

The designers have set out to make the performance of this receiver comparable with that of a mains-operated set. The HF valve is of the variable-mu screen-grid type, and the detector is a variable-mu HF pentode. "Gecalloy" iron-cored tuning coils are used, and the Class "B" output stage delivers 1,200 mW. to the permanent magnet moving-coil loud speaker.

Moulded Bakelite Cabinet

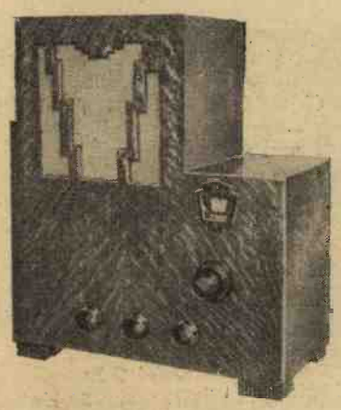
G.E.C. BATTERY
COMPACT THREE £5 17s. 6d.
Three-valve det.-LF Battery Receiver

The moulded bakelite cabinet is designed to house the HT and LT batteries. There is no grid bias battery, as automatic self-bias is applied. The loud speaker is of the permanent magnet moving-coil type.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Drummer Model B3.

G.E.C. AC/DC Three.



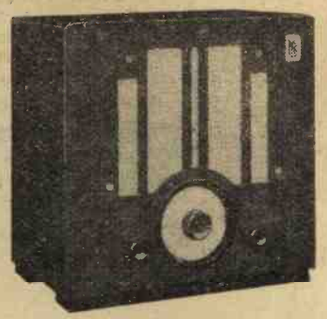
Hyvoltstar Miniature receiver with reflex circuit.

Inexpensive H.M.V. Set

H.M.V. LONG THREE,
MODEL 148 £7 19s. 6d.
Three-valve Battery-fed Receiver

At one end of the scale of H.M.V. productions we have the 110-guinea "High-fidelity" radio-gramophone, and, at the other, the present battery set, which, in spite of its low price, has quite an attractive specification. The circuit sequence is HF stage, grid detector, and pentode output feeding into a moving-coil speaker; current consumption is given as 8 mA., and the set, mounted in a horizontal cabinet, is supplied with full equipment.

The Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.



Kolster-Brandes AC-DC superhet.

Ekco Class "B" battery set.

Higgs DB2 battery receiver.

Band Pass Input

HIGGS DB2 8 gns.
Three-valve "Straight" Battery Receiver

The circuit arrangement is a screen-grid HF amplifier with band-pass input, triode detector and pentode output valve. The cabinet is of figured walnut, and a moving-coil loud speaker is included.

A similar set with two tuned circuits and a concentric trimming control is available at £8.

Two LF Stages

HIGGS DC2 £6 19s. 6d.
Three-valve det.-LF Battery Receiver

The circuit consists of a triode detector and first LF amplifier coupled to a pentode output valve. A moving-coil loud speaker is included, and the cabinet is finished in figured walnut. A similar circuit is employed in the Model DD2 at £5 12s. 6d., but the loud speaker is of the moving-iron type.

Charlton Higgs (Radio), Ltd., Westbourne Place, Hove, Sussex.

Double-acting Valve

HYVOLTSTAR MINIATURE
RECEIVER 8½ gns.
Universal Two-valve Receiver for AC or DC Mains

Although this set employs only two receiving valves (plus a power rectifier) all the operations of a normal HF-det.-2LF "straight" circuit are carried out. This is explained by the fact that the first valve performs the dual function of HF and LF amplification, while a Westector is used for signal rectification. Ostar-Ganz high-voltage valves are fitted.

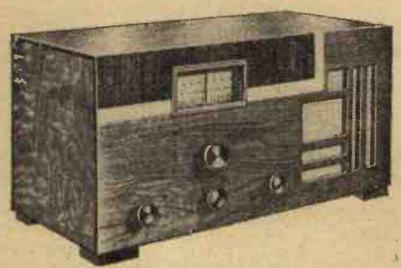
Universal High-Voltage Radio, Ltd., 28-29, Southampton Street, Strand, London, W.C.2.

Interchangeable for AC or DC

KOLSTER-BRANDES KB 381 10 gns.
Universal Four-valve Superheterodyne for AC or DC Mains

An up-to-date superheterodyne circuit and several interesting details of layout and design figure in this inexpensive AC-DC model. Automatic volume control is included, and the provision of a built-in filter should add greatly

G.E.C. Battery "Compact 3."



Drummer battery superheterodyne.

H.M.V. "straight" battery set, Model 148.

RECEIVERS: 10 GNS. AND BELOW (*Continued*)

to the pleasures of reception by giving a quieter background, even on "noisy" mains.

Completely Self-contained

KOLSTER-BRANDES "HIKA" PORTABLE 10 gns.
Four-valve Battery-fed Receiver Operating with Built-in Frame Aerial

This receiver, of the "trans-portable" type, is housed in an upright cabinet, and employs an HF-det.-2 LF circuit, with pentode output. There is a "local-distance" switch, and the tuning condenser is provided with an externally controlled trimmer.

Three Tuned Circuits

KOLSTER-BRANDES KB 333A £8 19s. 6d.
Three-valve Battery-fed Receiver. (De Luxe Model KB 364, £9 19s. 6d. Also KB 393, 6 gns.; Class "B" KB 363, 10 gns.)

When comparing receivers—and particularly those of the "straight" type—the number of tuned circuits should always be taken into account. Extra circuits add appreciably to cost, but should also add correspondingly to the true selectivity of the receiver. Model KB 333A has a total of three tuned circuits (including band-pass input) and an HF-det.-LF circuit, with pentode output feeding a moving-coil speaker.

A similar set in a more expensive cabinet costs £1 extra, while a simpler version, KB 393, with two tuned circuits, is sold at six guineas.

Model KB 363 has three-circuit tuning, but the pentode is replaced by Class "B" and driver valves.

Popular Det.-LF Model

KOLSTER-BRANDES NEW PUP KB 397 £6 17s. 6d.
Two-valve Receiver for AC Mains. (Battery Counterpart, KB 362, £5 15s. 0d.)

Where receiving conditions are reasonably good a detector-LF circuit, as used in this set, is quite adequate for short- and medium-distance work; the extreme simplicity of the circuit is a strong point in its favour, as the possibility of breakdown is correspondingly reduced.

The battery-fed equivalent, KB 362, has two LF stages instead of one, but is also fitted with a moving-coil loud speaker.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Double-acting Volume Control

LISSEN MODEL 8093 £9 15s. 0d.
Three-valve Receiver for AC Mains. (Battery Model 8073, £8 10s. 0d.; DC Mains Model 8043, 9 gns.)

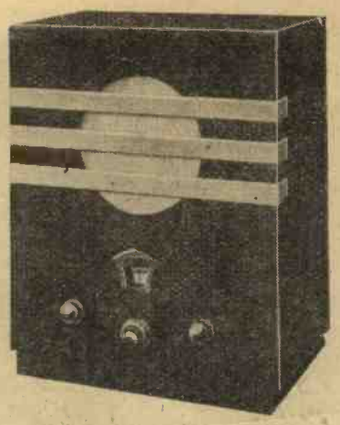
A special dual volume control, whereby HF valve bias and reaction are appropriately regulated by manipulation of a single knob, is an interesting feature of this receiver. A total of three tuned circuits gives promise of good selectivity, especially as iron-cored coils are fitted.

In both the battery and DC mains counterparts, pentode output valves are also employed; all models are basically similar in specification and are fitted with moving-coil speakers. The DC version includes a barretter voltage regulator.

Inexpensive Frame-aerial Set

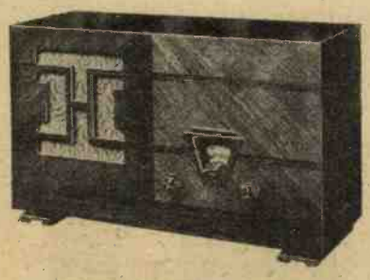
LISSEN MODEL 8102 9 gns.
Four-valve Battery-fed Receiver Operating with Built-in Frame Aerial

This recently-introduced "transportable" model is in an upright



Lissen Model 8099.

Lissen Model 8093 AC receiver.



Mullard MB Three receiver.

cabinet, and the circuit arrangement includes an HF stage and triode detector, followed by driver and Class "B" valves. The special Lissen double-acting volume control is retained, and the loud speaker is of the moving-coil type.

Two Cabinet Styles

LISSEN MODEL 8099 £7 15s. 0d.
Three-valve Battery-fed Receiver (Model 8098, £7 7s. 6d.)

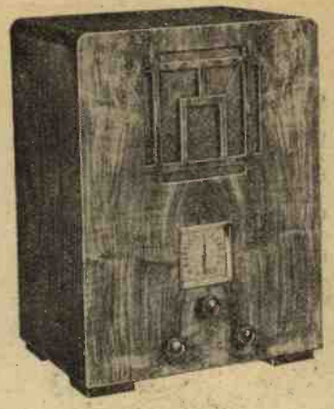
This set may be regarded as a simplified version of the Model 8073; except for the fact that there are only two tuned circuits, the specification is basically similar, and the useful dual volume control is included.

The cabinet work is dull black with chromium relief; Model 8098 is identical, except that it is mounted in a more conventional cabinet of figured walnut.

Detector-QPP Circuit

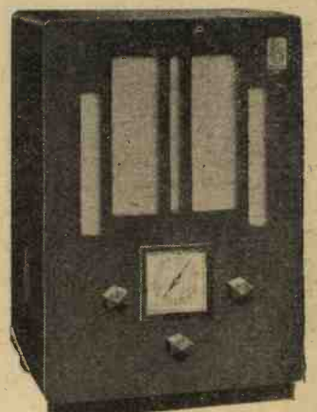
LISSEN MODEL 8044 £5 15s. 0d.
Three-valve Battery-fed Receiver

A triode detector valve feeding a pair of pentodes working in a QPP circuit should ensure good



Ormond Model 602.

Marconiphone Model 284.



Kolster-Brandes "New Pup"

volume coupled with economy in HT current consumption. The loud speaker is of the moving-coil type; a three-position tone switch is an unusual refinement in an inexpensive receiver.

Det.-2LF Circuit

LISSEN MODEL 8100 £4 10s. 0d.
Three-valve Battery-fed Receiver

A simple circuit, comprising a grid detector followed by two resistance-coupled LF stages and pentode output, is used in this low-priced model. A balanced-armature speaker is fitted.

Lissen, Ltd., Lissenium Works, Worple Road, Isleworth, Middlesex.

Automatic Tone Compensation

MARCONIPHONE MODEL 284 £7 19s. 6d.
Three-valve "Straight" Battery Receiver

The circuit consists of a screen-grid HF amplifier, detector and pentode output valve. An interesting feature is to be found in the design of the LF coupling transformer, the characteristics of which are designed to give automatic compensation for high-note loss due to reaction. The walnut cabinet may be obtained with alternative designs of loud-speaker fret.

All-Pentode Battery Set

MULLARD "M B THREE" 8 gns.
Three-valve Battery-fed Receiver

This is a more than usually interesting example of the straight HF-det.-LF circuit, if only for the reason that the latest multi-electrode valves are used throughout. Advantage has been taken of the fact that a screened pentode detector valve imposes little damping on the preceding tuned circuit to omit reaction entirely, and thus to simplify operation. Tuning coils are Litz-wound, and a moving-coil speaker is fitted.

The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.

Universal Det.-LF Set

ORMOND MODEL 604 £7 10s. 0d.
Two-valve Universal Receiver for AC or DC Mains

An HF pentode functioning as a leaky grid detector is followed by an output pentode valve and alternative aerial tappings are provided to enable the best selectivity to be obtained under different working conditions. The loud speaker is of the energised type, and a barretter lamp is included to maintain a constant heater current.

Iron-cored Coils

ORMOND MODEL 605 £7 10s. 0d.
Three-valve Self-contained Battery Receiver

The circuit consists of an HF stage with variable-mu pentode and iron-cored coils, a leaky grid detector and a pentode output valve. Frame aerials are wound round the inside of the cabinet, and their directional properties may be used to supplement the inherent selectivity of the circuit. The loud speaker is of the permanent magnet moving coil type, and a "clock face" tuning scale is fitted.

Dual Loud Speakers

ORMOND MODEL 603 £7 10s. 0d.
Three-valve Battery Receiver with Class "B" Output

This is the leading set in a range of detector-LF receivers in which the aim has been to combine good materials and workmanship with simplicity of design. The leaky grid detector is followed by a driver valve and a Class "B" output stage. There is provision for an external loud speaker of 2 ohms impedance, and sockets are also fitted for a gramophone pick-up. In the Model 603

RECEIVERS: 10 GNS. AND BELOW (*Continued*)

there is a pair of matched permanent magnet moving-coil loud speakers, but two other sets, Models 601 and 602, are available with single loud speakers in horizontal and vertical type cabinets respectively. The price of these sets is £6 10s.

The Ormond Engineering Co., Ltd., Rosebery Avenue, London, E.C.1.

Including AVC

PHILCO MODEL 264 — 10 gns.
Four-valve Superheterodyne for AC Mains

This is the basic superheterodyne chassis of the Philco range of receivers in its simplest form. Full AVC is included, and also a two-position tone control. The energised moving-coil loud speaker is capable of handling the full 3 watts available from the output stage.

Simplified Battery Connections

PHILCO MODEL 233 — 8 gns.
Three-valve "Straight" Battery Receiver

One-plug battery connections for HT and grid bias combined greatly simplifies the maintenance of this receiver and the Class "B" output valve ensures economy of the HT current. The single tuning control is associated with an illuminated dial calibrated in kilocycles, and special attention has been paid to smoothness of reaction.

Philco Radio & Tel. Corp. of Great Britain, Ltd., Aintree Road, Perivale, Greenford, Middlesex.

Two HF Stages

PHILIPS TYPE 834B — 10 gns.
Five-valve Battery-fed Receiver

The circuit arrangement of this unconventional receiver comprises two HF stages (one of which is aperiodic) followed by a triode detector and pentode output. The fifth valve regulates the supply of HT in accordance with the low-frequency output from the detector, and thus acts solely as a battery-economy device. There are two high-efficiency tuned circuits of the special Philips type.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

"Iron-cored" Circuits

R.I. RITZ MICRION III — 8½ gns.
Three-valve Battery-fed Receiver

This, the smallest of the R.I. series of receivers, embodies a "straight" HF-det.-LF circuit with Micrion iron-cored tuning coils. The moving coil speaker is fed by an economy pentode, and, as the total rated anode current is only 7 mA., HT maintenance costs should be low, especially as a high-capacity battery is fitted.

Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

Litz Coils

REGENTONE MODEL B/35 — £7 15s. 0d.
Three-valve "Straight" Battery Receiver

The circuit consists of a variable-mu HF amplifier with litz-wound coils followed by a detector and "economy" pentode output valve. The loud speaker is of the permanent magnet moving-coil type, and the tuning scale is calibrated with station names.

Regentone, Ltd., Worton Road, Isleworth, Middlesex.

Interchangeable Scale

SUNBEAM MODEL 55 — 10 gns.
Five-valve Universal Superhet for AC/DC Mains

The up-to-date circuit specification includes an octode frequency changer, variable-mu pentode IF amplifier, double-diode-triode detector and pentode output valve. The tuning scale is of the "aeroplane dial" type with shadow tuning indicator. The station-calibrated tuning scale is interchangeable.

A Midget Superhet

SUNBEAM MIDGET — 9 gns.
Three-valve Universal Superhet for AC and DC Mains

The circuit of this receiver is similar to that of the Model 32, but by skilful design the frontal dimensions of the cabinet have been reduced to 8in. × 10¾in. The tuning knob is approximately calibrated in wavelengths, and a 25-foot length of flexible aerial wire is supplied with each receiver.

Sunbeam Electric, Ltd., Park Royal Road, N. Acton, N.W.10.

Shadow Tuning

SUNBEAM MODEL 32 — £8 15s. 0d.
Three-valve Universal Superhet for AC/DC Mains

Fitted with the same type of tuning dial as the Model 55, this receiver incorporates a simplified superhet circuit in which the frequency changer and IF stages are both HF pentodes. A double-diode-pentode valve combines the functions of second detector and power output stages, and also provides AVC.

Novel Valve Combination

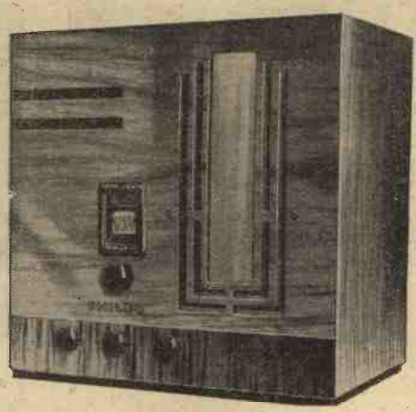
ULTRA MODEL 55 — £8 15s. 0d.
Universal Two-valve Receiver for AC or DC Mains

The circuit arrangement of this receiver is both practical and attractive, and, it is believed, is not to be found in any other set. The first valve is a pure HF amplifier, while the second is a double-diode-pentode which performs the functions of detection and output. A barretter acts as a regulator of mains voltage.

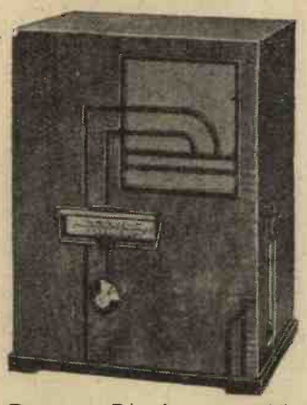
Ultra Electric, Ltd., Erskine Road, Chalk Farm, London, N.W.3.

Radio-gramophones and receivers costing more than 10 guineas have been described under convenient price classifications in the two preceding issues.

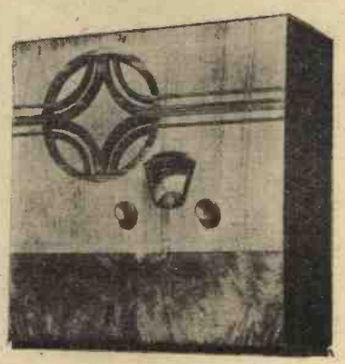
Sunbeam Midget.



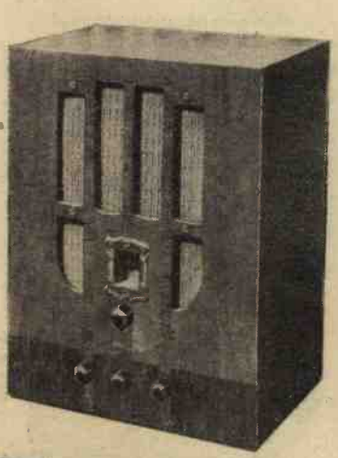
Philco Model 233 battery set.



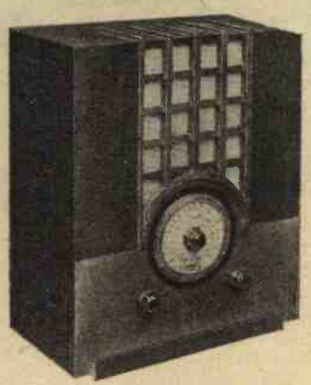
Regentone B/35 battery model.



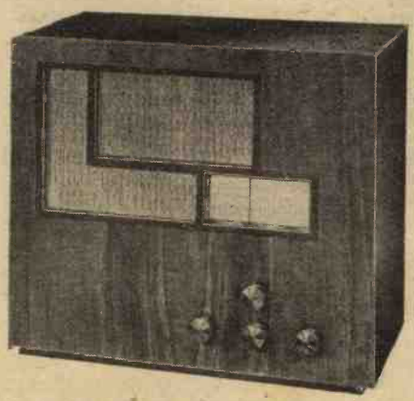
Philips Model 834b with two HF stages.



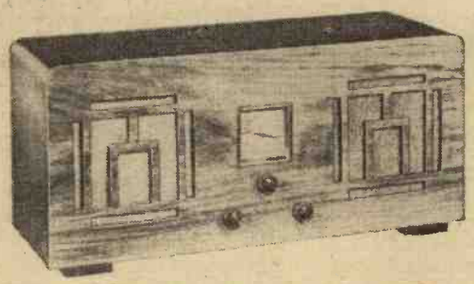
Philco Model 264 AC Superheterodyne.



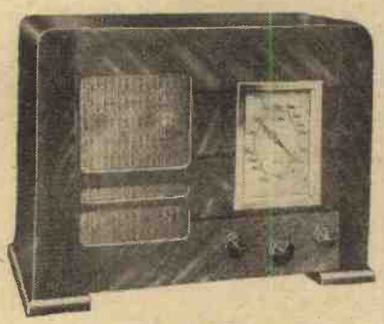
Sunbeam Model 55.



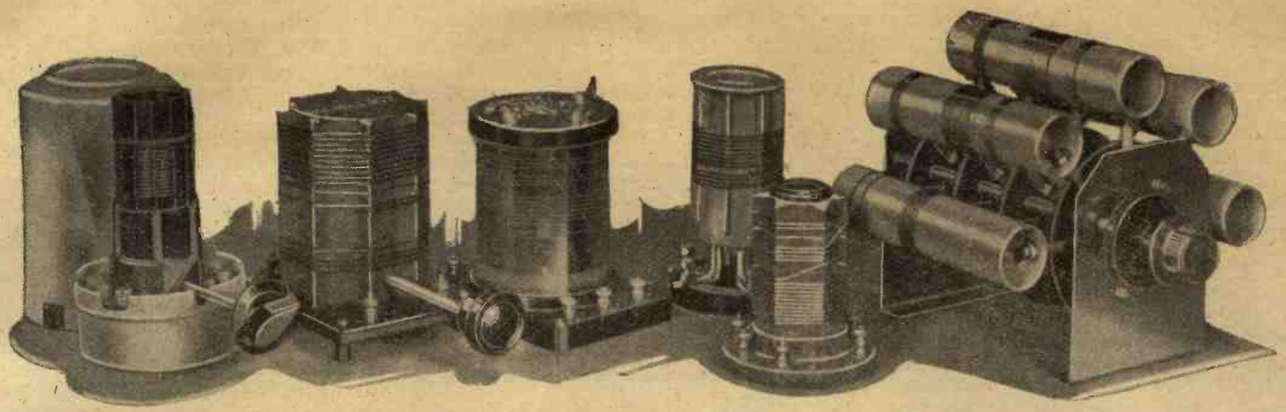
R.I. Micrion Battery Three.



Ormond Model 603 with dual loud speakers.



Ultra Universal Model 55.



SHORT-WAVE COMPONENTS

The Influence of Good Design Upon Receiver Performance

THE success of a short-wave receiver depends so much upon the quality and efficiency of the components used that it is thought a few notes on short-wave components may be useful. It is no exaggeration to say that there must be hundreds of short-wave constructors who have built receivers which are giving unsatisfactory results simply because the components used are totally unsuitable for the very high frequencies involved in short-wave reception. The components, however, may be perfectly suitable for use in standard broadcast receivers. In this article no attempt will be made to give details of the design of receivers or components, but it is hoped that the information given will be of use to readers when selecting their short-wave apparatus.

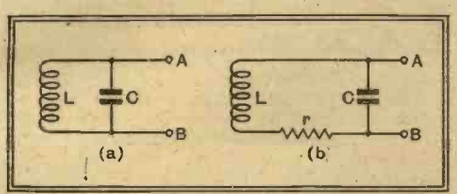


Fig. 1.—In a tuned circuit consisting of inductance L and capacitance C (a) the losses can be represented by a series resistance r (b).

In Figure 1(a) is shown a parallel tuned circuit which is common to every short-wave receiver. At first sight it appears that we may consider this small circuit as consisting only of an inductance L and a capacitance C, but investigation shows that this is not the case. At resonance, the reactance of L given by $2\pi fL$, and the capacitive reactance $1/2\pi fC$ balance each other and the current flowing through the circuit is given by Ohm's law. As in the DC circuit, $I=E/r$, where E is the impressed voltage across the parallel circuit and r is an equivalent resistance (see Fig. 1(b)).

According to theory, this current should rise to an infinite value, and when multiplied by the reactance of either L or C, give rise to a large voltage across the terminals A and B which may conveniently be the grid/filament input of a valve.

Due to losses, however, in the coil and condenser, r is not negligible and the circuit cannot be considered as a simple LC circuit. Therefore, any current flowing through r causes waste of energy and the object in short-wave component design is to make this equivalent series resistance as low as possible, or, in other words, to make the circuit "low loss."

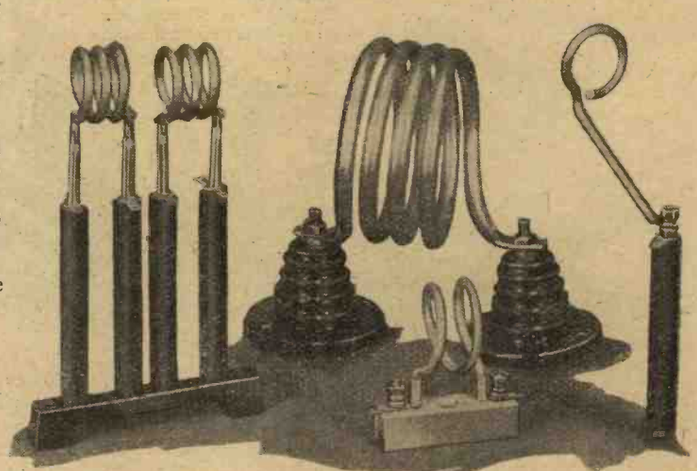
The title picture at the top of the page shows a range of modern short-wave coils including Colvern, Morley, R.I., Eddystone, Lissen and Bulgin all-wave coil unit.

The magnification of the circuit which we have been considering is given by the ratio of the coil reactance, $2\pi fL$, to the resistance r, and thus the smaller we make r, the greater the magnification. It may be mentioned in passing that r does not have a constant value but varies over the range of wavelengths used, and thus it is practically impossible to obtain constant magnification from a set covering a large range of frequencies.

Reducing Dielectric Loss

Short-wave coils should be made small if they are to be efficient, so that their external field is limited. The former on which a coil is wound should be chosen for its low dielectric losses. The latter may be reduced by using very little solid dielectric where the field is intense, choosing the material with care and by spacing the turns on the coil.

To reduce losses due to the dielectric being in the field of the coil, the coils should be wound on hollow formers and these should be of the ribbed type in order to keep the winding as far away from the former as possible. High-grade ebonite, Mycalex, Isolantite, Frequentite and DL-9 are suitable materials which have been specially developed for high-frequency work and have extremely low-power factors.



Specialised components comprising Eddystone ultra short-wave coil-unit, Goltone transmitting coil and Bulgin 5-metre coil.

It is found that when a coil and condenser are connected in parallel as in Fig. 1(a), the natural frequency is not given by $f=1/2\pi\sqrt{LC}$, but by a lower value. This is due to the fact that the coil L is not only inductive but has a certain small value of capacitance. Between every turn of the coil a capacitance exists and thus a coil really consists of a large number of small capacitances in series. These are distributed along the turns of the coil and thus at high frequencies a certain amount of current does not flow in the coil at all but is by-passed, causing losses. The latter are usually expressed as one equivalent parallel capacitance CL, which, in parallel with the condenser C, increases the natural wavelength of the coil. This equivalent parallel capacitance CL is known as the self-capacitance of the coil, and thus the actual natural frequency of the tuned circuit is given by $f=1/2\pi\sqrt{L(C+CL)}$. To reduce the losses incurred, the self-capacitance is decreased by spacing the turns of the coil by a distance equal to several times that of the diameter of the wire used.

The number of grid turns should be such as to cover the required waveband with the known tuning condenser. Reaction turns, if required, should be only just sufficient to obtain properly balanced control. The smallest number of turns possible to provide adequate oscillations should be employed in order to minimise the influence of reaction on tuning. As a rough approximation, it may be said that the reaction turns should

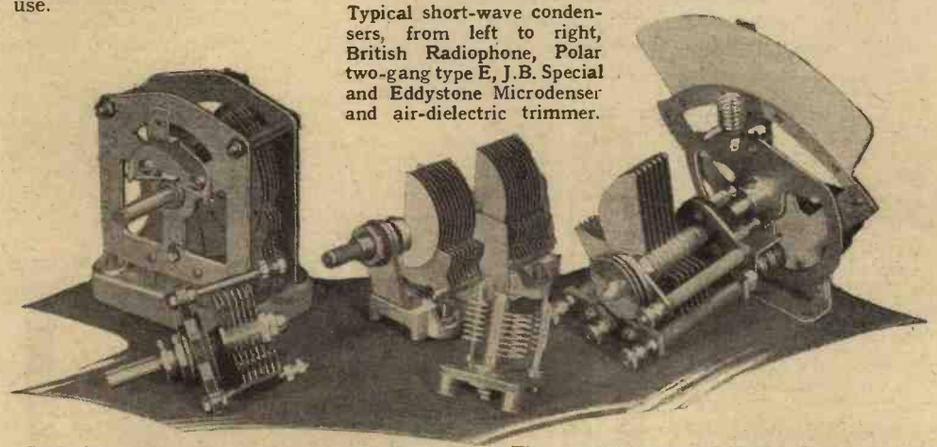
Short-wave Components—

be anything from a half to one-third the number of grid turns.

Since at high frequencies the current flows almost entirely along the surface of the wire, any plating on a coil should be chosen with care. As silver is the best conductor known, silver-plated wire has been used for short-wave coils, but at radio frequencies the conductivity of silver is only a few per cent. greater than that of copper so that the latter wire is employed. The advantages of enamelled wire are numerous, the chief one being that the surface area is always maintained bright, and thus oxidisation does not occur with its increase in high-frequency resistance. Where large values of HF current are being passed, as in amateur transmitting plate circuits, hollow copper tubing may be used, dipped and lacquered to prevent oxidisation. The tube should not be nickel-plated, which is sometimes done by amateurs who wish their transmitters to have a good finish, as this increases the high-frequency resistance as much as eight times. On the other hand, tinning does not affect the resistance to a great extent. With the thickness of tinning usually deposited by commercial processes, the final resistance is only very slightly increased.

Eelex Duplex two-range coil; wave-change is effected by reversing coil in holder.

Mechanically, the coils should be made rigid so that the turns do not move when in use, which would, of course, alter the calibration of the set. Ribbed formers, threaded suitably, are useful to prevent this occurring, or the formers themselves may be grooved and the wire placed in the grooves. If interchangeable coils are used, the pins in the coil base should be a tight fit and they should not work loose after use.



Typical short-wave condensers, from left to right, British Radiophone, Polar two-gang type E, J.B. Special and Eddystone Microdenser and air-dielectric trimmer.

In a short-wave receiver the worst offender from the point of view of losses is the tuning condenser, which must have negligible resistance. Unless care is taken in the selection of this component, losses may be introduced, making it quite possible to obtain condensers which have a higher HF resistance than the coil associated with them. On this account it is obvious that air is the only suitable dielectric to use, tuning condensers with a bakelised-paper dielectric being entirely unsuitable.

As in the case of short-wave coils, a certain amount of power is wasted in a tuning condenser when it is connected in circuit. First of all we have the actual current leakage between the plates, and, secondly, the loss which occurs in the dielectric by the electrostatic field cutting it when a varying potential is applied across the plates of the condenser.

We may, therefore, look upon a tuning condenser as a perfect capacitance, taking a leading current 90 deg. out of phase with the voltage, in parallel with a non-inductive resistance R (Fig. 2(a)).

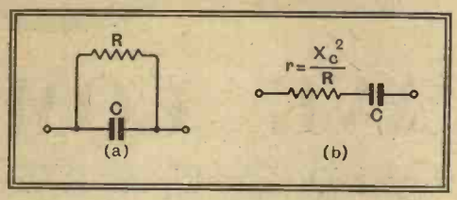


Fig. 2.—Losses in a condenser may be regarded as a shunt resistance R (a) which can be converted into a series resistance r (b) for computing the total loss in the circuit.

By mathematical juggling we can convert this equivalent shunt resistance to an equivalent series resistance r, as we did in the case of the tuning inductance. This may be shown to be equivalent to X_C^2/R ohms, where $X_C = 1/2\pi fC$ (see Fig. 2(b)).

It will be noticed that the equivalent series resistance r becomes extremely small as the frequency is increased since $X_C^2 = 1/4\pi^2 f^2 C^2$. In fact, it is inversely proportional to the square of the frequency and therefore the power loss occurs chiefly by dielectric absorption.

In the selection of a tuning condenser we should be careful to choose one in which the amount of dielectric material used for supporting the plates is small. Even then, this material should be of special high frequency composition, such as one of the materials recommended for coil formers, placed out of the most intense part of the electrostatic field of the plates.

The metal plates should be of brass, soldered together. This latter point is of great importance as it is found that the normal method of using spacing washers causes the efficiency to be reduced due to these washers becoming oxidised. There should be no "end play" in the spindle, that is to say, the spindle should not have any movement at right angles to its axis of rotation. Noise should not be produced when the moving plates are rotated. Various ingenious methods have been employed by manufacturers to overcome this difficulty, two particularly good types being made. One uses bearings of the same insulating material, while the other has an insulated non-inductive pigtail which is threaded down the centre of a hollow driving spindle, ensuring a positive connection to the moving plates.

Tuning Condenser Values

To prevent crowding of stations, the tuning capacitance used should not be greater than 100 m.mfd., i.e., 0.0001 mfd. The ratio of maximum to minimum capacitance must be as high as possible to give a large tuning range with a given coil. The significance of this statement may be seen from the following reasoning.

In Fig. 3 L and C are the tuning inductance and capacitance respectively. C1 and C2 are small capacitances representing the wiring and grid/filament capacitances. The capacitance of the leads C1 would be about 5 m.mfd. and C2 would be roughly 8 m.mfd.

Using a well-designed condenser for C, of 100 m.mfd. capacitance, we should have a minimum capacitance of 5 m.mfd. The ratio of maximum/minimum capacitance is therefore 113/18, or roughly 6:1. With a given inductance the tuning range would be approximately 2.5:1. Let us assume the coil tunes from 20 to 50 metres.

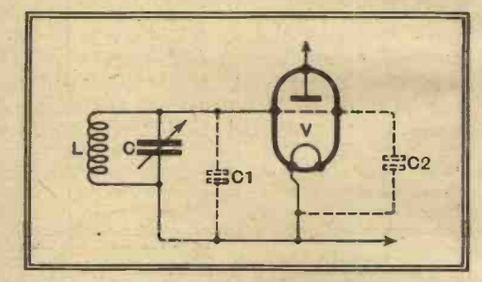


Fig. 3.—The total capacitance in a circuit comprises condenser C and small capacitances C1 and C2 representing wiring and grid/filament of valve.

Now, consider a badly designed condenser with a minimum capacitance of 20 m.mfd. This gives us a maximum/minimum ratio of only 113/33, or 3.4:1. The tuning range is 1.8:1, so with an inductance of smaller value to that previously considered we should get from 20 to 36 metres.

Slow-motion tuning is absolutely essential for short-wave work, and this should not be incorporated in the condenser itself. A properly designed slow-motion drive should be used.

Fixed condensers used for decoupling may be similar to those used in broadcast receivers provided they are of the non-inductive type.

Switched coils may be used, as in broadcast receivers, although the design of the switch calls for a considerable amount of skill. A self-cleaning contact is essential for noiseless reception and the resistance must not increase after use. A small amount of metal should be employed in an effort to reduce the capacity to the smallest possible value.

Fig. 4 illustrates one method which has proved to be extremely efficient in use. Notice the separate grid, primary and reaction windings switched-in on all wave-ranges, making it possible to proportion the turns of the various windings so that a good compromise between sensitivity and selec-

Short-wave Components—

tivity is obtained. Such a multi-wave coil unit calls for careful design as unless care is taken "blind spots" will occur. These are points at which it is entirely impossible to obtain reaction, due to the self-capacitances and self-inductances of the various coils, out of circuit, resonating and forming an absorption circuit to the coil switched in parallel with the tuning condenser.

Ordinary on-off switches of the push-pull type are totally unsuitable. The type of switch to be recommended is the one in which a lightly sprung contact arm moves over a number of contact studs, forming a self-cleaning connection.

This group includes the Kinva and Goltone short-wave HF chokes, Bulgin 5-pin valveholder on steatite base and stand-off insulator, also Eddystone 7-pin chassis valveholder on base of new DL-9 insulating material.

Coil bases and valveholders are made in two styles (a) flush mounting, (b) baseboard mounting. In the former type the sockets must make good contact with the pins of the coil or valve and the dielectric used for insulating purposes should have superior high-frequency properties. The leakage path between the sockets must be as long as possible—some manufacturers use ribs between the sockets to prevent flux accumulating when soldered connections are employed.

The baseboard mounting coil base or valveholder usually consists of several sockets arranged around the circumference of an insulating ring. The chief point to notice is whether the sockets are of one-piece metal construction. If they are not a thermo-couple effect may be caused, creating noise in the receiver, due to the small electromotive forces being generated at the junction of the metals. The high-grade insulating ring should be raised on pillars to reduce the capacity to earth when a metal chassis is used.

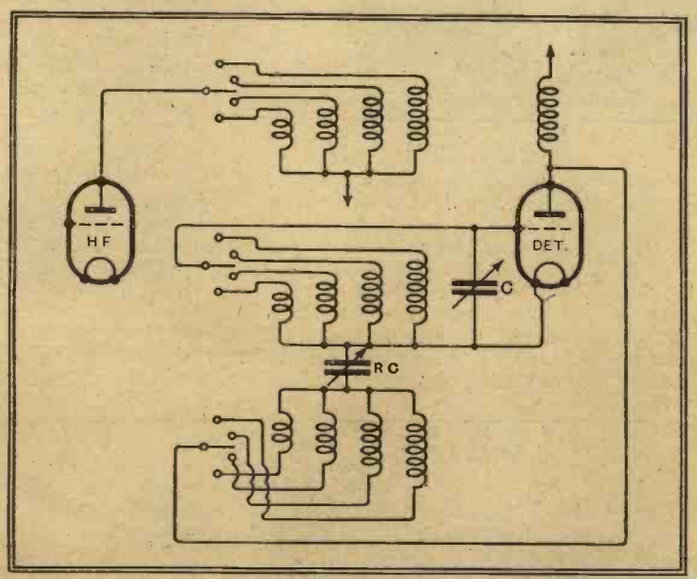


Fig. 4.—Switching arrangement for multi-range coil unit providing separate primary, grid and reaction windings for each range.

HF chokes should have a small external field, combined with as high an inductance as is possible with a low self-capacitance. A high-frequency choke, due to these properties, resonates, forming a high impedance at the natural frequency. As the latter rises the impedance of the choke increases until the maximum is attained at resonance. Since the choke is put into a circuit to form a barrier to high-frequency currents, a condenser must be used with it to by-pass these currents to earth. The natural frequency should be above the maximum wavelength to be covered and the self-capacitance must be very low, i.e., in the order of 1 or 2 m.mfd. In an endeavovur to obtain a high inductance with a low self-capacitance, some chokes are wound in sections connected in series. The inductances of the sections are added together, while the self-capacitances are in series, making the effective capacitance extremely low. No subsidiary resonances should occur or "blind spots" be noticed when tuning the receiver. The latter are due to acceptor circuits being formed at certain frequencies due to the sections combining with the self-capacitances between them.

For 30-60 megacycle work suitable chokes may be made by space-winding the coil. A natural wavelength of above 40 metres is suitable for such wavelengths, while for general short-wave reception the natural wavelength should not be below 200 metres.

A suitable former must be used and the chokes may be screened if used in a compact receiver where the field must be limited.

The tuning dial of a short-wave receiver plays a very important part in the ease by which stations may be tuned in. A slow-motion type is essential. Some amateurs prefer a reduction ratio as high as 100:1, but provided several coils are used to cover the wave-range desired a ratio of 15:1 is suitable.

As the effectiveness of a short-wave receiver depends so much upon an efficient reaction control, the condenser provided for this purpose should be noiseless and have a slow-motion movement incorporated in its design. This will be very useful when receiving a weak telephony carrier as it enables the detector to be kept right on the verge of oscillation.

The Diary of an Ordinary Listener

WITH the coming of winter, atmospherics, the frequent bane of summer listening, cease to trouble, but, on the other hand, background noises seem more prevalent and careful tuning is necessary to avoid ghastly whispers or faint echoes of saxophones and trumpets.

On Thursday, December 6th, I settled down to enjoy Haydn's "Creation" from Copenhagen and Kalundborg, of which the orchestra and choir, conducted by Fritz Busch, gave an excellent performance, but a distinct background of almost inaudible speech resembling far-distant curses accompanied the evil spirits in their descent into the deep abyss, while later, the tender dove calling to his mate was answered by the bleating of a saxophone in a different key; an effect hardly contemplated by "Papa Haydn," even in his most jocular mood.

The programme on Friday from Turin and Trieste was very much to my taste as it began with Schubert's "Unfinished Symphony" and Dukas' "Apprenti Sorcier," followed by a very good performance of Rossini's "Stabat Mater," which came through well, though I do not think the microphone can have been well placed for the chorus, whose *sotto voce* effects were practically inaudible. In fact, had I not been following the music with the vocal score I should not have been aware that any singing was going on. The principals were distinct even in the softest passages, especially the two sopranos in the duet "Quis est homo?"

Sunday's programmes offered a varied choice, and I first tuned in Frankfurt for a violin concerto by Busoni in which Georg Kulenkampff played the solo instrument with the Station Symphony orchestra conducted by Rosbaud. Later I settled down to hear Beethoven's "Emperor" Concerto from Cologne and other German stations in which the pianoforte part was splendidly played by Elly Ney, and the Station Orchestra gave a good rendering of the stirring music.

A Satisfied Victorian

On Monday the Concertgebouw Orchestra from Amsterdam, with a mixed choir, gave a fine performance of one of Handel's less-known oratorios, "Belshazzar," which came through very clearly from Hilversum. I noted with much satisfaction that the *continuo* was played on the harpsichord instead of being entrusted, as is so often the case, to the more modern pianoforte.

The French stations have lately been giving us a good deal of Mendelssohn's music, and as I am sufficiently Victorian to admire this tuneful composer I make no complaint but only ask for more. At Bordeaux-Lafayette I happened upon the Overture to "A Midsummer Night's Dream."

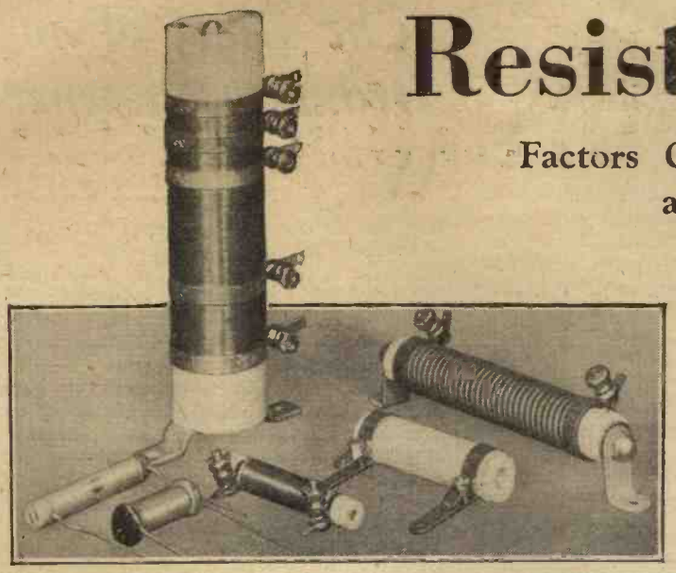
The Station Orchestra at Frankfurt gave a good rendering of Tchaikowsky's 5th Symphony on Tuesday evening, which came through very well on the whole, though affected by fading at times.

Afterwards I went over to Radio Toulouse to find a Mendelssohn concert well under way with many popular numbers, including the "Wedding March," "On the Wings of Song," and the inevitable "Spring Song."

CALIBAN.

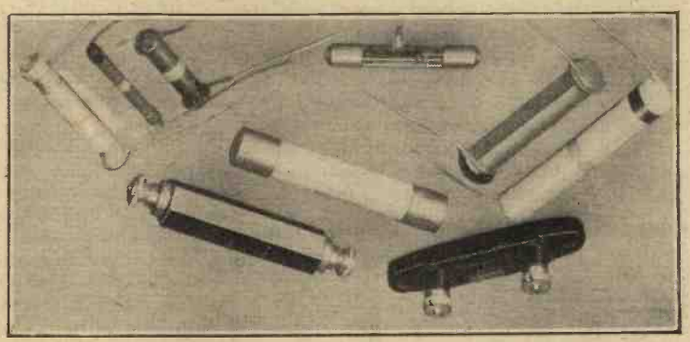
Resistance Ratings

Factors Governing the Design of Fixed and Variable Resistances



Types of wire-wound fixed resistances showing Bulgin mains, 40- and 10-watt; Dubilier 10-watt Spirohm; Watmel 3-watt and Amplion one-watt models.

THE principal function of a resistance in a wireless circuit is to provide a difference in voltage across its ends, and this is utilised in various ways for the operation of the set. As current must flow through the resistance to produce this voltage difference, or potential drop as some prefer to regard it, energy is absorbed and this is dissipated in the form of heat. Thus we find resistances being graded in terms of the watts they will handle, for the watt is the electrical unit of power which in a DC circuit is given by the product of amperes and volts or amperes squared multiplied by the resistance in ohms. This applies also to an AC circuit provided the load is a pure resistance.



Group of modern synthetic resistors. Reading from left to right, Bryce 2-watt; Claude Lyons B.A.T. 2-watt; Ferranti baseboard type; Dubilier Metallised 2-watt; Graham-Farish Ohmite 3-watt; Loewe vacuum grid leak; one-watt Polar-N.S.F.; 0.5-watt Ferranti and Erie one-watt.

A resistance dissipating one watt will, therefore, generate a certain amount of heat irrespective of its size, but one of very small dimensions will become hotter than one several times as large, other factors being the same, since the one with the larger area will be able to radiate away its heat much quicker than the smaller.

Fixed Types

These are, perhaps, very elementary facts, but they have some bearing on the choice of resistances in our wireless receivers, though the constructor is not often required to exercise his discretion in such matters, since resistance makers have carefully graded their products and provide figures for normal operating conditions of all sizes, allowing for a rise in temperature that is neither excessive nor likely to damage nearby components. The only occasion that calls for prudence is when assembling mains resistances, and those dissipating a large wattage, for, despite the generous size of these models, heat is generated far quicker than the air can convey it away unless good ventilation is allowed.

The two principal types of resistances now in general use are synthetic and wire-wound. The synthetic type might be sub-divided into two groups, those in which the resistance material is moulded into a stick or rod and those having the resistance material deposited on to a tube, rod or strip, which may be encased in heat-resisting material or coated with a suitable enamel. This type can be made in values of from 100 ohms to many megohms.

Fixed resistances and those that can be varied in value might well be differentiated by describing the former as resistors and the latter as potentiometers or volume controls, for these generally have three connections, one at each end of the resistance element and one to the sliding contact.

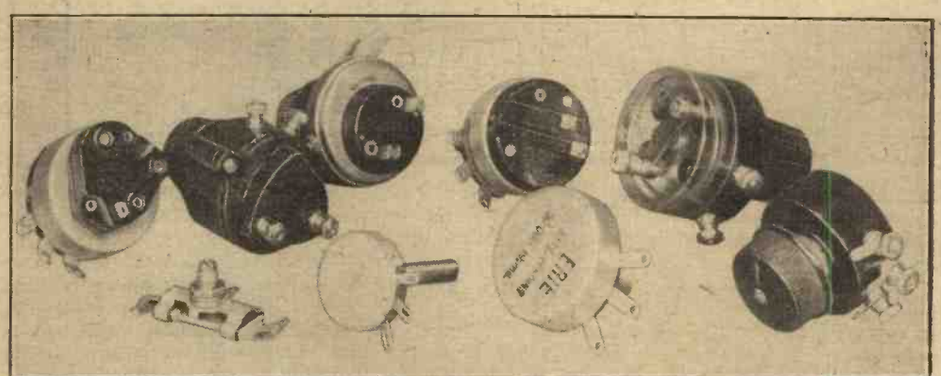
Resistors of one-watt rating or smaller find application for decoupling and voltage dropping in HF circuits. For LF amplifiers it may often be necessary to employ two-, three- or four-watt models, according to the magnitude of the DC currents flowing. As anode impedances in LF circuits there is little to choose between the wire-wound and the synthetic type. At one time all but wire-wound anode resistances were regarded with disfavour for use in resistance-coupled amplifiers, as these were the only style that ensured a low background level. Improvements in the manufacturing processes have now almost entirely eliminated this defect, and synthetic resistors can be used, and indeed are used in unbelievable quantities for this purpose, not only in ordinary broadcast sets but in high-gain resistance-coupled microphone and gramophone amplifiers.

Graded Volume Controls

Variable resistances and potentiometer-type volume controls up to about 100,000 ohms in value are, as a rule, fitted with wire-wound elements; where higher values are needed the composition type will answer, for it is unlikely that currents much in excess of 0.5 to 1 mA. will pass through the resistance, and in most cases the component will be included in a grid circuit and not required to pass DC but handle only the audio-frequency potentials.

A component in which the resistance of the element is evenly distributed throughout is not necessarily the best as a volume control in the grid circuit of a valve, as at one end of the resistance track small movements of the slider will give big changes in volume whilst elsewhere it will have very little effect.

To double the power in the output circuit it is necessary to increase the grid voltage by 1.414 times; therefore the volume control resistance should be so graded that it follows a logarithmic law. These volume controls are variously described as graded, log or logarithmic, and cost only a little more than the plain type. Both wire-wound and synthetic models are available fitted with mains and three-point battery switches.



Modern volume controls comprising Polar-N.S.F.; Bulgin; Ferranti and Claude Lyons Stackpole with switches incorporated; also plain types of L.E.W., Erie and Lissen, and Claude Lyons Hum-Dinger.

Broadcast Brevities

By Our Special Correspondent

Countering the "Mike Crashers"

"MIKE crashing" of the kind which occurred during "Music Hall" last week is causing genuine concern among the "O.B." engineers who, after all, are the persons responsible for providing a trouble-free transmission.

A Directional Device

Everyone agrees that it is very rude to hurl unsolicited remarks at the defenceless microphone, but no two people at Broadcasting House seem to be agreed as to the best method of dealing with culprits.

Electron Method

One man whom I consulted last week suggested a directional device whereby, if the microphone were addressed from the rear, it would "shoot an electron" at the offender, extirpating him painlessly and without mess.

Another said that the engineers must get over the difficulty by "listening all the time." In other words, they must be ready to switch off within a split second if anything untoward occurs.

Pity the Engineers

It happened that, when the "Music Hall" interruption occurred, Flotsam and Jetsam were broadcasting, hence the engineers were glued to their 'phones and were able to switch off immediately. Things might be very different, however, during a chamber music broadcast in the Concert Hall.

Fewer London Listeners

THE drop of 9,000 in the number of London licence-holders during November has caused very little concern at Broadcasting House. "What are nine thousand among so many?" is the official attitude, and if the figures show an upward tendency in December this official outlook is probably the right one.

A Rival Broadcasting Concern?

But the phenomenon of a licence drop does raise this question: How far can the licence numbers diminish before the B.B.C. makes an anxious effort to improve the programmes?

It would seem that the only definite stimulus in this direction would be provided by a rival broadcasting organisation. There is likely to be a definite move towards the establishment of such an organisation when the new broadcasting Charter comes into being in 1937. Feeling is strong in certain quarters against the diffusion of British programmes from Continental stations and the co-operation of the Government will very likely be sought with the object of keeping in the country money which is at present going abroad.

Why Programmes are Better

To day the B.B.C. programmes are probably better than they have been for many months past and I venture to predict that the standard will be maintained without any relaxation of effort until the existing Charter comes to an end.

It is surprising what miracles can be achieved by the mere hint of a rival organisation!

Waste of Time?

The Corporation's attitude in the matter is that such announcements would take up a lot of time, particularly in view of the fact that B.B.C. programmes are relayed to the Continent with almost monotonous regularity, not only to Germany but to France, Denmark, and many other countries.

The Wireless Military Band is extremely popular in Germany.

Polyglot Good-night?

Perhaps the B.B.C. might devise an occasional polyglot "Good Night" which could be given in as many as a dozen languages on the lines of the late Mr. Stobart's "Grand Good Night" on New Year's Eve.

Such an announcement need not be a daily affair, but if employed, say, once a week, would be taken as a graceful gesture by our Continental friends and would at least justify the Corporation's motto *apropos* speaking peace unto nations.

A Passing Personality

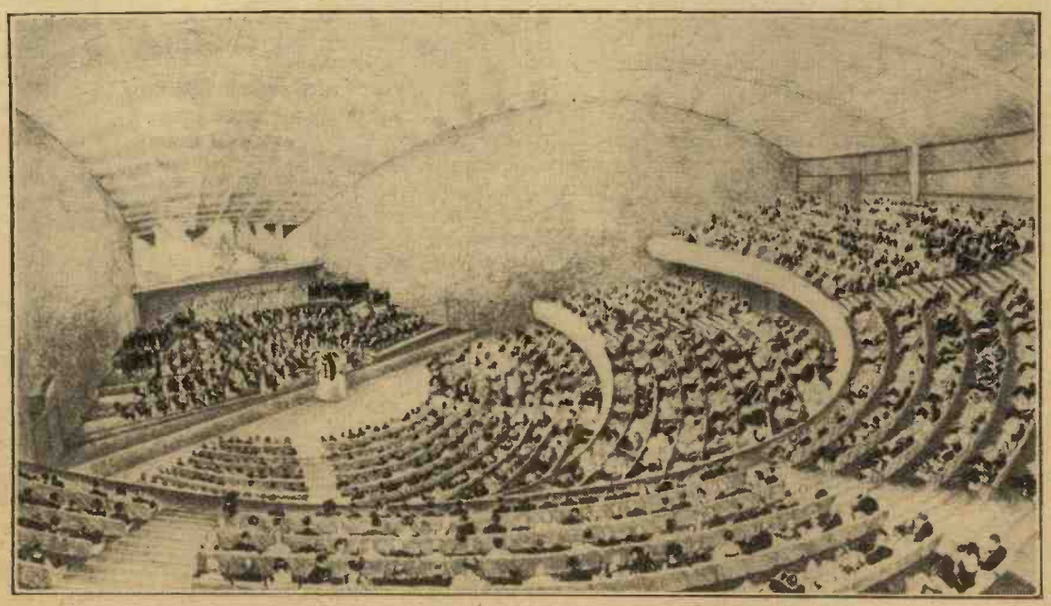
Mr. Felton explains that in this programme there will be no judgment on the past year, and no thought of any axe to grind. The programme will just create the impression of 1934 as a personality passing away, and the advent of a new one, 1935.

This review of events will be carried out by contrasting voices. There will be six narrators. After the watch-night service in Winchester Cathedral a carillon will conclude with "Auld Lang Syne."

A Dane Speaks Out

DENMARK prefers Daventry, or, as a Copenhagen friend puts it, "Old Dane Tree." Reading in the *Wireless World* of the complaints concerning the fading of Droitwich he sat down to a six days' listening test, which has led him to support the arguments of other correspondents.

"Reception," he writes, "is generally considerably marred by distortion, and the station sounds like a man with a cold talking through a layer of cotton wool. Anyway, I have found that reception of the B.B.C. programmes is about twenty times better from any of the Regional or National medium-wave stations than via Droitwich."



A SWIRL OF SOUND will enwrap the audience in this spectacularly constructed "Hall of Broadcasting," seating 1,600 persons, which has been designed for the new Danish "Broadcasting House" in Copenhagen. We should mention that the above is only one of many designs submitted!

Announcing in German

A WRITER in the *Daily Telegraph* last week urged the B.B.C. to announce certain concerts in German when it is known that the programme is being relayed to Germany. He pointed out that the German programmes frequently include announcements in English.

On New Year's Eve

FELIX FELTON, who is a new recruit from the O.U.D.S. to the B.B.C. Dramatic Department, is devising and producing the special New Year's Eve feature programme entitled "Hail and Farewell"—recording the transition from old year to new.

FOUNDATIONS OF WIRELESS

V.— Capacity and Inductance in High-frequency Circuits

AN understanding of the properties of capacity and inductance in radio-frequency circuits is essential for a proper appreciation of the working of all wireless apparatus, whether for transmission or reception.

By A. L. M. SOWERBY, M.Sc.

(Continued from page 511 of December 14th issue)

IN considering the behaviour of a condenser in a direct-current circuit, we saw that the application of a voltage distorts the atoms of the dielectric by displacing such electrons as are movable. The result of this movement of electrons is the momentary charging current on the basis of which the capacity of the condenser is determined. We also saw that when the displacing voltage is removed the electrons spring back to their normal places, providing a second momentary current in the reverse direction to the first, and refunding to the circuit the energy stored in charging the condenser.

The behaviour of a condenser towards alternating current is best brought out by considering the effect of a number of successive charging currents in alternate directions. Imagine a circuit such as that of Fig. 21, consisting of a battery E, a condenser C, and a rotary reversing-switch S. This latter is shown as four spring contact-arms, or *brushes*, numbered 1 to 4, pressing against the surface of a revolving drum or *commutator*. Except for the two segments, which are of metal, the commutator is supposed to be made of fibre, or other insulating material. In the position

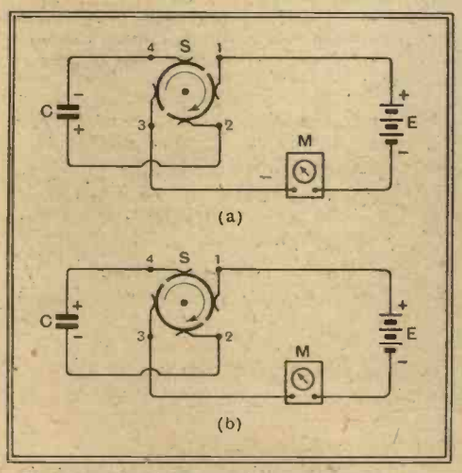


Fig. 21.—Condenser and battery, with rotating reversing switch. The behaviour of this circuit leads directly to the properties of capacity in an AC circuit.

shown at *a*, the commutator serves to join 1 to 2 and 3 to 4; when rotated through 90 degrees, as at *b*, it makes the connections 2 to 3 and 4 to 1. Turned again, through a further 90 degrees, the connections at *a* are re-established.

Tracing through the connections resulting from these two positions of the commutator, it will be observed that in position *a* the upper plate, and in position *b* the lower plate, of the condenser is connected to the negative side of the battery.

Suppose that the circuit is first set up with the commutator as at *a*. On making the final connection that completes the circuit a charging current will flow into the condenser, resulting in a momentary deflection of the meter M. Reversing the connections by a quarter-turn of the commutator will connect the positive side of the battery to the negatively-charged side of the condenser; its tendency to discharge is now assisted by the battery, and a double quantity of electricity flows. This is made up of the discharge-current, immediately followed by the charging-current necessary to charge it to its new polarity. M will record this by showing a large deflection in the opposite direction to the first.

Apparently Continuous Current

If the commutator is turned slowly the meter will kick, first one way and then the other, every time the direction of connection is changed. By speeding up the rotation it will be found possible to make these alternations of direction so fast that the needle of the meter remains stationary in its central position through sheer inability to follow the successive kicks of current.

But if we replace this meter by another so designed that it deflects always in the same direction, no matter which way the current flows, the successive deflections produced by slow rotation of the commutator will simply fuse together as the speed of rotation is increased, the sluggishness of the meter preventing it from falling back to zero between successive rushes of current. We shall then have evidence of a current flowing, apparently continuously, in a circuit which is broken by the insulating material between the plates of the condenser. But, as the way in which the current has been built up clearly shows, electrons are flowing *in and out of* the condenser, and not *through* it in the ordinary sense of the word.

During each momentary burst of current the flow is greatest at the beginning and tails off towards the end, as the curve of Fig. 22 shows. The more rapid the rotation of the commutator, therefore, the greater is the proportion of the total time during which the current is high, and the greater, in consequence, is the average current read on the meter.

Instead of taking this rapidly reversing current from a battery and a mechanical switch, it can be drawn from any normal source of alternating or high-frequency

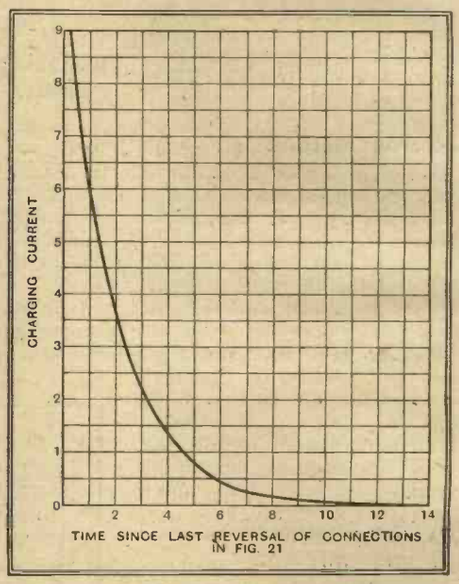


Fig. 22.—Showing the rapidity of the decay of the current after each reversal of direction.

current, such as the electric light mains. If, as suggested in Fig. 23, a lamp (40-watt is recommended for the experiment) is connected to AC mains through a condenser of capacity some 2 mfd. or more, the lamp will light, *and stay alight* (compare Fig. 7). But its brilliance will be below normal.

In the absence of the condenser, the alternating current drives electrons to and fro in the lamp filament; with the condenser in circuit, the sole difference is that the elastic opposition of the electrons in the dielectric restricts, to some small extent, the number of electrons that can so move at each change in direction of the voltage.

As has already been indicated, the obstruction offered by a condenser to the flow of current depends upon its capacity and upon the frequency of the current, becoming less as either of these rises. If an alternating potential of RMS voltage E at a frequency f cycles per second is applied to a condenser of capacity C farads the current flowing through it is $E \times 2\pi fC$ amperes RMS, where π is the ratio of the

Foundations of Wireless—

circumference of a circle to its diameter. The numerical value of this is 3.1416, or 22/7 approximately. A resistor to draw the same current would have a resistance of $1/2\pi fC$ ohms; this figure is called the *reactance* of the condenser to currents of frequency f, and is expressed in ohms. In the case of the 2 mfd. condenser of Fig. 23, the reactance to 50-cycle current will be $1/2\pi fC = 1/2\pi \cdot 50 \cdot 2 \cdot 10^{-6} = 10^6 / 200\pi = 1590$ ohms.

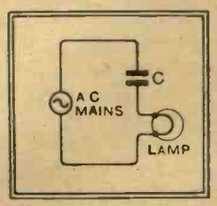


Fig. 23.—If a condenser of large capacity (2 μF or more) is placed in series with a lamp lighted from AC mains, the lamp will light, though with less than normal brilliance. Compare Fig. 7.

It is particularly to be noted that the electricity passed into the condenser at one instant bounces out again the next; the passage of an alternating current through a condenser *does not involve the expenditure of energy*. If a resistance were used in place of C in Fig. 23, it would get hot, showing that this method of dimming the lamp diverts some of the unwanted energy to the resistance and there wastes it. Equal dimming by using a condenser wastes no power, as can be shown by the fact that C remains stone cold.

For this reason its opposition to the current is not called resistance, the passage of current through which always involves the expenditure of energy.

Losses in Condensers

It is only in the ideal case, however, that the energy returned to the circuit on discharge is fully equal to that stored in charging the condenser, just as it is only a theoretically perfect spring that expands perfectly after compression. Imagine a "spring" made of copper wire, for example! Since energy is lost when a current flows through such a condenser, it must possess resistance as well as reactance. This can be expressed, as in Fig. 21, by adding a resistance, either in series or in parallel, to the simple symbol for capacity. The energy lost in such a composite circuit depends on the resistance alone, and can be calculated, in case *a*, by the formula $W = E^2/R$, where E is the voltage across both condenser and resistance, and in case *b*, by the formula $W = I^2r$, where I is the current flowing through the two in series.

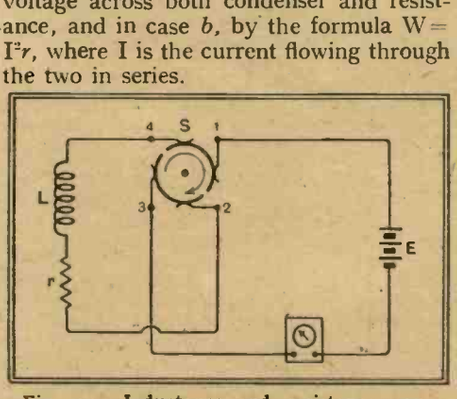


Fig. 24.—Inductance and resistance connected, through reversing switch, to a battery.

Besides imperfections of dielectric, a further source of energy loss in a condenser is found in the resistance of the connecting wires and of the plates themselves. The condenser of Fig. 23, if used at a frequency of 1,500 kc/s, will have a reactance of $1/2\pi \cdot 1500 \cdot 10^3 \cdot 2 \cdot 10^{-6} = 1/6\pi = 0.053$ ohm. Connecting wires and plates are evidently likely to have a resistance of at least this value, so that although they can be ignored at 50 cycles, where the reactance is 1,590 ohms, they may play a big part in the behaviour of the condenser at radio-frequencies.

Practical Forms of Condenser

Any two plates separated from one another form a condenser, but varying modes of construction are adopted for varying purposes. A variable tuning condenser, of capacity up to some 0.0005 mfd., consists of two sets of metallic vanes which can be progressively interleaved with one another to obtain any desired capacity up to the maximum available. "Fixed condensers" consist of a number of metal plates interleaved with thin sheets of mica, or, if a large capacity is required, of two long strips of metal foil separated by waxed paper and rolled up into a compact block. Where the passage of a small amount of direct current from plate to plate does not matter, electrolytic condensers are used to give a very high capacity in a small space at moderate cost.

The capacities most used run from 0.0001 μF. to 0.01 μF. with mica insulation, 0.01 to 4 μF. with paper insulation, and 4 to 50 μF. in the electrolytic type.

Inductance

It will be remembered that the characteristic of inductance is to delay the rise or fall of a current in a circuit, this being due to the formation or collapse of a magnetic field. If we imagine an inductance and a resistance replacing the condenser of Fig. 21, making the circuit of Fig. 24, then on first completing the circuit the current will grow in the manner shown in the curve of Fig. 25. At sufficiently slow speeds of rotation of the commutator the total time taken by the growth of the current in alternate directions will be negligible compared with the time of steady flow, and the average current will be practically that which the resistance alone would take from the battery. At a higher speed, reversal might take place each time as soon as the current had risen to the value A of Fig. 25; the average current will now be smaller, but still considerable. By increasing the speed the reversal might be made so frequent as to prevent the current from ever exceeding B, or even C. It is clear that the greater the frequency of reversal the less will be the average current.

If an alternating voltage is applied to a coil the current that flows will be determined both by the frequency of the applied voltage and by the inductance of the coil, decreasing as either of these is raised. The resistance needed to take the same current, at a frequency f, as a coil of inductance L, is $2\pi fL$ ohms, where L is in henrys and f in cycles per second. This value is therefore the reactance of the coil to currents of frequency f.

As in the case of the condenser, no power is consumed by driving a current against the opposition that this reactance represents, because the energy put into the magnetic field in building it up is restored to the circuit when it collapses. The resistance of the wire with which the coil is wound involves, of course, the usual consumption of energy, being I^2r, where I is the current flowing.

An inductance consists in all normal cases of a coil of wire. As a tuning coil it has been usual, till recently, to wind the coil on a tubular former of bakelite or cardboard; some 100 turns of wire on a former of 1½in. diameter provide 170 μH. or thereabouts for tuning over the medium wave band. A high-frequency choke, of inductance perhaps 200,000 μH, will generally be wound of many turns of fine wire on a slotted former, though it may be a self-supporting coil of "wave-wound" type. Such a choke will offer a reactance of 1.26 megohms at $f = 1{,}000$ kc/s, while having a reactance of only 6,290 ohms at 5,000 cycles per second. Such a component is called a high-frequency choke for the rather obvious reason that it opposes, or chokes back, the flow of currents of high frequency, while allowing those of speech-frequency a relatively unimpeded passage.

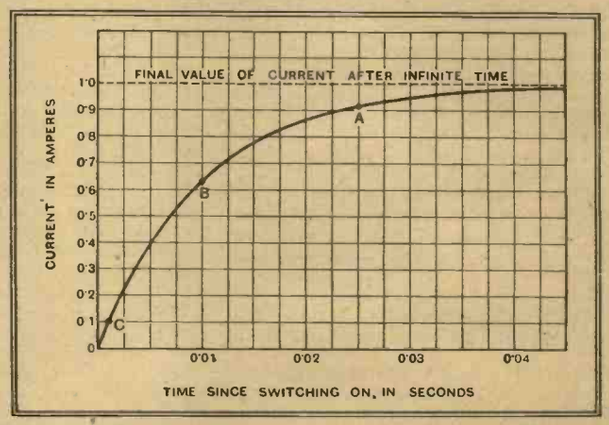


Fig. 25.—Showing slow rise of current in circuit of Fig. 24. Calculated for E = 100 v, L = 1.0 H, r = 100 ohms. By sufficiently rapid rotation of the switch, the current could be kept below A (1/40th sec.), below B (1/100th sec.), or even below C (1/1,000th sec.).

If it is necessary to offer considerable impedance to currents of quite low frequency, it is evident that a much higher inductance than this is necessary. To obtain high inductance without excessive resistance the coil is wound round a core of iron, or iron alloy, which offers a much easier passage than air to the lines of magnetic force, and so, by increasing the magnetic field, puts up the inductance which is a manifestation of that field.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(Stations with an aerial power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.
Kaunas (Lithuania)	155	.....	1935	7
Brazov (Romania)	160	.....	1875	20
Huizen (Holland). (*Until* 3.40 *p.m.*)	160	.....	1875	7
Kootwijk (Holland) (*Announced Huizen*). (3.40 *p.m. onwards*)	160	.....	1875	50
Lahti (Finland)	166	.....	1807	40
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	174	.....	1724	500
Paris (Radio Paris) (France)	182	.....	1648	75
Istanbul (Turkey)	187.5	.....	1600	5
Berlin (Deutschlandsender Zeesen) (Germany) (*S.-w. Stns.*, 16.89, 19.73, 25.51, 31.38 *and* 49.83 *m.*)	191	.....	1571	60
Droitwich	200	.....	1500	150
Minsk, RW10 (U.S.S.R.)	208	.....	1442	35
Reykjavik (Iceland)	208	.....	1442	16
Paris (Eiffel Tower) (France)	215	.....	1395	13
Motala (Sweden). (*Relays Stockholm*)	216	.....	1389	30
Novosibirsk, RW76 (U.S.S.R.)	217·5	.....	1379	100
Warsaw, No. 1 (Raszyn) (Poland)	224	.....	1339	120
Ankara (Turkey)	230	.....	1304	7
Luxembourg	230	.....	1304	150
Kharkov, RW20 (U.S.S.R.)	232	.....	1293	20
Kalundborg (Denmark) (*S.-w. Stn.*, 49.5 *m.*)	238	.....	1261	60
Leningrad, RW53 (Kolpino) (U.S.S.R.)	245	.....	1224	100
Tashkent, RW11 (U.S.S.R.)	256.4	.....	1170	25
Oslo (Norway)	260	.....	1154	60
Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)	271	.....	1107	100
Tiflis, RW7 (U.S.S.R.)	280	.....	1071·4	35
Rostov-on-Don, RW12 (U.S.S.R.)	355	.....	845	20
Sverdlovsk, RW5 (U.S.S.R.)	375	.....	800	50
Geneva (Switzerland). (*Relays Sottens*)	401	.....	748	1.3
Moscow, No. 3 (RCZ) (U.S.S.R.)	401	.....	748	100
Voroneje, RW25 (U.S.S.R.)	413.5	.....	726	10
Oulu (Finland)	431	.....	696	2
Ufa, RW22 (U.S.S.R.)	436	.....	688	10
Hamar (Norway) (*Relays Oslo*)	519	.....	578	0.7
Innsbruck (Austria). (*Relays Vienna*)	519	.....	578	0.5
Ljubljana (Yugoslavia)	527	.....	569.3	5
Viipuri (Finland)	527	.....	569.3	13
Bolzano (Italy)	536	.....	559.7	1
Wilno (Poland)	536	.....	559.7	16
Budapest, No. 1 (Hungary)	546	.....	549.5	120
Beromünster (Switzerland)	556	.....	539.6	100
Athlone (Irish Free State)	565	.....	531	60
Palermo (Italy)	565	.....	531	4
Stuttgart (Mühlacker) (Germany)	574	.....	522.6	100
Grenoble, P.T.T. (France)	583	.....	514.6	15
Riga (Latvia)	583	.....	514.6	15
Vienna (Bisamberg) (Austria)	592	.....	506.8	120
Rabat (Radio Maroc) (Morocco)	601	.....	499.2	6.5
Sundsvall (Sweden). (*Relays Stockholm*)	601	.....	499.2	10
Florence (Italy). (*Relays Milan*)	609	.....	492.6	20
Cairo (Abu Zabal) (Egypt)	620	.....	483.9	20
Brussels, No. 1 (Belgium). (*French Programme*)	620	.....	483.9	15
Lisbon (Bacarena) (Portugal)	629	.....	476.9	15
Tröndelag (Norway)	629	.....	476.9	20
Prague, No. 1 (Czechoslovakia)	638	.....	470.2	120
Lyons, P.T.T. (La Doua) (France)	648	.....	463	15
Cologne (Langenberg) (Germany)	658	.....	455.9	100
North Regional (Slaithwaite)	668	.....	449.1	50
Sottens (Radio Suisse Romande) (Switzerland)	677	.....	443.1	25
Belgrade (Yugoslavia)	686	.....	437.3	2.5
Paris, P.T.T. (Ecole Supérieure) (France)	695	.....	431.7	7
Stockholm (Sweden)	704	.....	426.1	55
Rome, No. 1 (Italy) (*S.-w. stn.*, 25.4 *m.*)	713	.....	420.8	50
Kiev, RW9 (U.S.S.R.)	722	.....	415.5	36
Tallinn (Esthonia)	731	.....	410.4	20
Madrid, EAJ2 (Radio España) (Spain)	731	.....	410.4	3
Munich (Germany)	740	.....	405.4	100
Marseilles, P.T.T. (France)	749	.....	400.5	1.6
Katowice (Poland)	758	.....	395.8	12
Midland Regional (Daventry)	767	.....	391.1	25
Toulouse, P.T.T. (France)	776	.....	386.6	0.7
Leipzig (Germany)	785	.....	382.2	120
Barcelona, EAJ1 (Spain)	795	.....	377.4	5
Lwow (Poland)	795	.....	377.4	16
Scottish Regional (Falkirk)	804	.....	373.1	50
Milan (Italy)	814	.....	368.6	50
Bucharest (Romania)	823	.....	364.5	12
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832	.....	360.6	100
Berlin (Funkstunde Tegel) (Germany)	841	.....	356.7	100
Bergen (Norway)	850	.....	352.9	1
Sofia (Bulgaria)	850	.....	352.9	1
Valencia (Spain)	850	.....	352.9	1.5
Simferopol, RW52 (U.S.S.R.)	859	.....	349.2	10
Strasbourg, P.T.T. (France)	859	.....	349.2	15
Poznan (Poland)	868	.....	345.6	16
London Regional (Brookmans Park)	877	.....	342.1	50
Graz (Austria). (*Relays Vienna*)	886	.....	338.6	7
Limoges, P.T.T. (France)	895	.....	335.2	0.5
Helsinki (Finland)	895	.....	335.2	10
Hamburg (Germany)	904	.....	331.9	100
Toulouse (Radio Toulouse) (France)	913	.....	328.6	60
Brno (Czechoslovakia)	922	.....	325.4	32
Brussels, No. 2 (Belgium). (*Flemish Prog'mme*)	932	.....	321.9	15
Algiers, P.T.T. (Radio Alger) (Algeria)	941	.....	318.8	12
Göteborg (Sweden). (*Relays Stockholm*)	941	.....	318.8	10
Breslau (Germany)	950	.....	315.8	17
Paris (Poste Parisien) (France)	959	.....	312.8	100
West Regional (Washford Cross)	977	.....	307.1	50
Cracow (Poland)	986	.....	304.3	2
Genoa (Italy). (*Relays Milan*)	986	.....	304.3	10
Hilversum (Holland). (7 *kW.* till 6.40 p.m.)	995	.....	301.5	20
Bratislava (Czechoslovakia)	1004	.....	298.8	13.5
North National (Slaithwaite)	1013	.....	296.2	50
Barcelona, EAJ15 (Radio Asociación) (Spain)	1022	.....	293.5	3
Königsberg (Heilsberg Ermland) (Germany)	1031	.....	291	60
Parede (Radio Club Português) (Portugal)	1031	.....	291	5
Leningrad, No. 2, RW70 (U.S.S.R.)	1040	.....	288.5	10
Scottish National (Falkirk)	1050	.....	285.7	50
Bari (Italy)	1059	.....	283.3	20
Tiraspol, RW57 (U.S.S.R.)	1068	.....	280.9	4
Bordeaux, P.T.T. (Lafayette) (France)	1077	.....	278.6	12
Zagreb (Yugoslavia)	1086	.....	276.2	0.7
Falun (Sweden)	1086	.....	276.2	2
Madrid, EAJ7 (Union Radio) (Spain)	1095	.....	274	7
Madona (Latvia)	1104	.....	271.7	50
Naples (Italy). (*Relays Rome*)	1104	.....	271.7	1.5
Alexandria (Egypt)	1122	.....	267.4	0.25
Belfast	1122	.....	267.4	1
Nyiregyhaza (Hungary)	1122	.....	267.4	6.2
Hörby (Sweden). (*Relays Stockholm*)	1131	.....	265.3	10
Turin, No. 1 (Italy). (*Relays Milan*)	1140	.....	263.2	7
London National (Brookmans Park)	1149	.....	261.1	50
West National (Washford Cross)	1149	.....	261.1	50
Kosice (Czechoslovakia). (*Relays Prague*)	1158	.....	259.1	2.6
Moravska-Ostrava (Czechoslovakia)	1158	.....	259.1	11.2
Monte Ceneri (Switzerland)	1167	.....	257.1	15
Copenhagen (Denmark). (*Relays Kalundborg*)	1176	.....	255.1	10
Kharkov, No. 2, RW4 (U.S.S.R.)	1185	.....	253.2	10
Frankfurt (Germany)	1195	.....	251	17
Prague, No. 2 (Czechoslovakia)	1204	.....	249.2	5
Lille, P.T.T. (France)	1213	.....	247.3	5
Trieste (Italy)	1222	.....	245.5	10
Gleiwitz (Germany). (*Relays Breslau*)	1231	.....	243.7	5
Cork (Irish Free State) (*Relays Athlone*)	1240	.....	241.9	1
Juan-les-Pins (Radio Côte d'Azur) (France)	1249	.....	240.2	2
Rome, No. 3 (Italy)	1258	.....	238.5	1
San Sebastian (Spain)	1258	.....	238.5	3
Nürnberg and Augsburg (Germany) (*Relay Munich*)	1267	.....	236.8	2
Christiansand and Stavanger (Norway)	1276	.....	235.1	0.5
Dresden (Germany) (*Relays Leipzig*)	1285	.....	233.5	1.5
Aberdeen	1285	.....	233.5	1
Austrian Relay Stations	1294	.....	231.8	0.5
Danzig. (*Relays Königsberg*)	1303	.....	230.2	0.5
Swedish Relay Stations	1312	.....	228.7	1.25
Budapest, No. 2 (Hungary)	1321	.....	227.1	0.8
German Relay Stations	1330	.....	225.6	1.5
Montpellier, P.T.T. (France)	1339	.....	224	5
Lodz (Poland)	1339	.....	224	1.7
Dublin (Irish Free State) (*Relays Athlone*)	1348	.....	222.6	1
Milan, No. 2 (Italy) (*Relays Rome*)	1348	.....	222.6	4
Turin, No. 2 (Italy). (*Relays Rome*)	1357	.....	221.1	0.2
Basle and Berne (Switzerland)	1375	.....	218.2	0.5
Warsaw, No. 2 (Poland)	1384	.....	216.8	2
Lyons (Radio Lyons) (France)	1393	.....	215.4	5
Tampere (Finland)	1420	.....	211.3	1.2
Newcastle	1429	.....	209.9	1
Béziers (France)	1429	.....	209.9	2
Paris, (Radio LL) (France)	1429	.....	209.9	2
Miskolc (Hungary)	1438	.....	208.6	1.25
Fécamp (Radio Normandie) (France)	1456	.....	206	10
Pecs (Hungary)	1465	.....	204.8	1.25
Bournemouth	1474	.....	203.5	1
Plymouth	1474	.....	203.5	0.3
International Common Wave	1492	.....	201.1	0.1
International Common Wave	1500	.....	200	0.6
Liepàja (Latvia)	1737	.....	173	0.1

NOTE. Since the publication of the previous list alterations have been made to the particulars of the following stations: Breslau (Germany), Florence (Italy), Kalundborg (Denmark), Marseilles (France), Pecs (Hungary), Toulouse (France), Turin (Italy).

WORLD RADIO

gives all

Christmas Programmes

from abroad

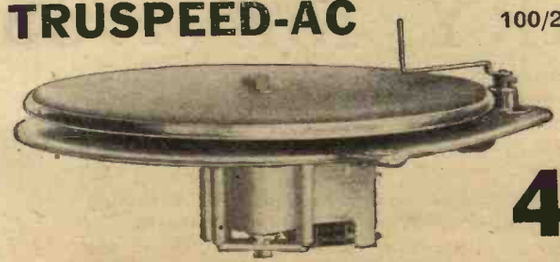
ENLARGED Christmas Number — **6d.**

from all Newsagents, Booksellers, and Bookstalls

B T-H

ELECTRIC GRAMOPHONE MOTORS

TRUSPEED-AC 100/250 Volts



49/6

The most powerful A.C. Machine offered for gramophone work
The only self-starting A.C. motor in which the speed cannot vary

Write for Free Booklet AG. 490

Other models include :—

TRUSPEED-DC for D.C. circuits Price **67/6**

UNIVERSAL for A.C. and D.C. circuits Price **99/6**

All fitted with automatic stop switches

BTH RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND

A1765 N

"Look, boys..

Tom's got a PIFCO ROTAMETER for CHRISTMAS!"

42/-

YOU can see the envy of his schoolmates as the lucky owner of a PIFCO ROTAMETER-DE-LUXE proudly displays his gift. He will now be able to make sure of the Radio over the holidays. Troubles quickly traced in every kind of radio test—get one yourself to-day at any good-class Radio dealer or Electrician—you must see this amazing instrument. Write to PIFCO WORKS, SHUDEHILL, MANCHESTER, or 150 Charing Cross Road, London, W.C.2.

The Pifco ROTAMETER de Luxe is nine testing instruments in one. You get either of the following at the turn of the knob.

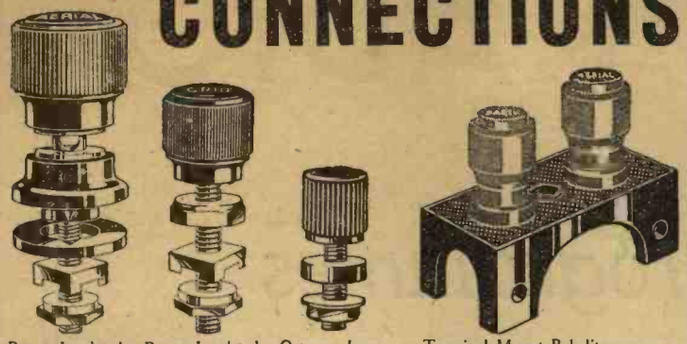
1. 0-5 volts.
2. 0-20 volts.
3. 0-100 volts.
4. 0-400 volts.
5. 0-10 milliamperes.
6. 0-50 milliamperes.
7. 0-250 milliamperes.
8. Resist. valve test.
9. Plug-in test for valves.

PIFCO ROTAMETERS

PIFCO ON THE SPOT WILL TRACE YOUR TROUBLES LIKE A SHOT

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

RADIO CONNECTIONS



B type. Insulated. Self-bushing. lettered, 6d.

R type. Insulated, lettered, 3d.

Q type. Insulated, 2d.

Terminal Mount Bakelite, use on side or upright, No. 1039, 6d.

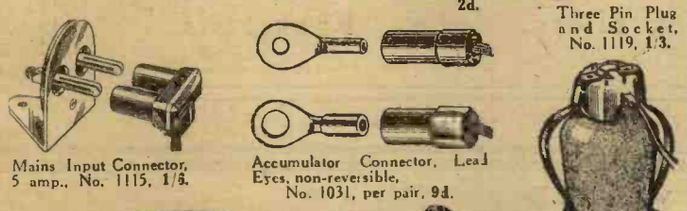
Spade lettered, No. 1025, 2d.

Bowspring Wanderplug, No. 1112 1½d.

Midget Wanderplug, 3 Prong, No. 1019, 2d.

Banana, Plug, No. 1021, 2½d. Socket, No. 1071, 2d.

Three Pin Plug and Socket, No. 1119, 1/3.



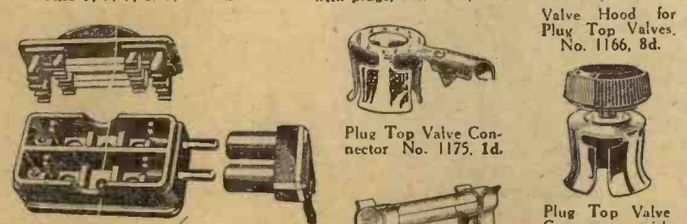
Mains Input Connector, 5 amp., No. 1115, 1/3.

Accumulator Connector, Lead Eyes, non-reversible, No. 1031, per pair, 9d.

Battery Cords, 4 way. 1/9. Also 5, 6, 7, 8, 9, 10 way.

Socket Strips, moulded, lettered with plugs, No. 1047, 9d.

Valve Hood for Plug Top Valves, No. 1166, 8d.



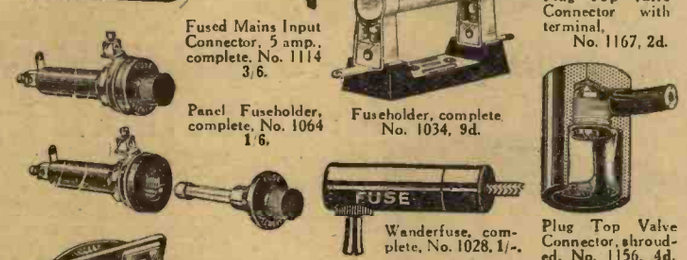
Plug Top Valve Connector No. 1175, 1d.

Plug Top Valve Connector with terminal, No. 1167, 2d.

Fused Mains Input Connector, 5 amp., complete, No. 1114 3/6.

Panel Fuseholder, complete, No. 1064 1/6.

Fuseholder, complete No. 1034, 9d.



Wanderfuse, complete, No. 1028, 1/-.

Plug Top Valve Connector, shrouded, No. 1156, 4d.

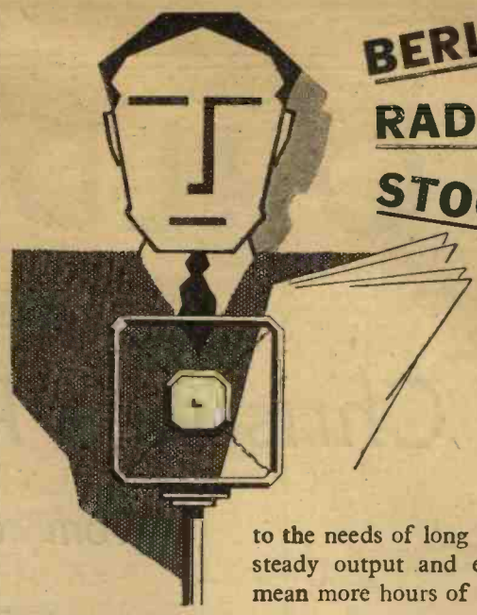
Spare Fuses from 60 m/a, colour coded, all ratings, 6d.

Twin Safety Fuseholder, complete. No. 1033, 2/6.

Write for FREE Copy Radio Connections

BELLING & LEE LTD

CAMBRIDGE ARTERIAL ROAD, ENFIELD, MIDDX



BERLIN

RADIO PARIS

STOCKHOLM

However selective your set may be, you need good batteries to get the pick of the Continental programmes. The new 'Anodex' are particularly suited to the needs of long range receivers. Their steady output and extra reserve of power mean more hours of full strength reception.

'ANODEX'

DRY BATTERIES

S. SMITH & SONS (Motor Accessories) LTD. SMITH'S MA CRICKLEWOOD WKS., LONDON, N.W.2

For Every Wireless Enthusiast

The Wireless World DIARY for 1935

In addition to the usual pages—one week at an opening—This handy little diary contains 79 pages of facts, formulæ and general information of the kind that is always wanted but is difficult to memorise.

There is a complete list of European Broadcasting Stations and Short-Wave Stations of the World. In addition an important section contains all the essential technical data relating to valves on the British market, including the latest type of frequency changers, pentodes and multi-electrode valves.

Fourteen pages of circuit diagrams of receivers amplifiers and rectifiers are also included, as well as useful information on the prevention of mains interference, and data for winding coils.

NOW ON SALE

Size 3½ by 4½ inches, 192 pages. Bound leather cloth, back loop with pencil.

PRICE 1/6 net. By post 1/7

From all booksellers, stationers and bookstalls or direct from the Publishers

ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD ST., LONDON, S.E.1

W.W.66

MISCELLANEOUS ADVERTISEMENTS

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THE CHARGE FOR ADVERTISEMENTS in these columns is

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ADVERTISEMENTS for these columns are accepted up to FIRST POST on MONDAY MORNING (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on SATURDAY MORNING at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26B, Renfield Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made payable to ILIFFE & SONS Ltd., and crossed & Co. Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

IMPORTANT NOTICE.

Owing to the Christmas Holidays, the next issue of "THE WIRELESS WORLD" (dated December 28th) is closing for press earlier than usual.

In accordance with the Notice that appeared last week, the latest date upon which Miscellaneous Advertisements could be accepted for the above issue was FIRST POST, THURSDAY, December 20th.

Set Manufacturers' Surplus, Clearance and Bankrupt Stocks offered in any of these columns may not be Manufacturers' current lines. Radio components advertised at below the list price do not carry any manufacturer's guarantee.

RECEIVERS AND AMPLIFIERS, ETC.

UTILITY SALES Super Bargain.—Delivery before Christmas; order immediately.

HANDSOME Table Model 5-valve 200-250v. A.C. Set, 3 screened grid, pentode, rectifier, energised moving coil, illuminated dial, chassis build, volume to fill hall, 40-50 stations, from Normandy to Budapest, not Midget; £4/15/6.

TELEVISION, with guaranteed results; start with us now, complete kit, universal motor, lamp, lens, disc, etc., everything is there; £3/12/6.

UTILITY SALES, Faeritone Corner, 57, Praed St., London. Paddington 0251. [7261

REGENTONE 2v. A.C., excellent condition; cost 130/-, accept 35/-.—Box 2469, c/o *The Wireless World*. [7256

PYE P.B. 5-valve Portable, perfect condition, £5, or with H.T. unit for home use, £6/10.—Jasper, 3, Eaton Rise, W.5. [7251

OUR Kit of Parts for "Wireless World" Quality Amplifier, complete in every detail, including valves; amplifier only, £8/10; feeder unit, 36/-.

OUR Kit of Parts for "Wireless World" Olympic S.S. Six, complete in every detail, including valves and loud-speaker; £14/10.

OUR Kit of Parts for "Wireless World" Standard A.C.3, complete with valves and speaker; £11/10.

SEND for Detailed List of Components for Either of the Above Kits; carriage paid, cash with order.

WARD, 46, Farringdon St., London, E.C.4. 'Phone: Holborn 9703. [6907

1935 Manufacturer's Stock, 4-valve A.C. Band-pass receivers, walnut cabinets, Mazda valves, Rola speakers; £5/10; approval against cash.—Maude, 1, Martin St., Brighouse. [7116

£6/19/6.—Craven 5-valve superhet, 200-250-volt, Plessey chassis, Magnavox moving coil, complete with B.V.A. valves, in futuristic walnut cabinet, full 3 watts output; listed £14/14; c.o.d. or c.w.o., carriage forward.—Kay, 167, City Rd., E.C.1. [7264

CHRISTMAS GREETINGS

To all who deserve them, and especially to all Hartley-Turner customers at home and overseas.

Just one year ago we announced the arrival of the Hartley-Turner Kit Set, thus making possible, with the Hartley-Turner speaker, the first realistic reproduction of broadcasting. Since then, hundreds of listeners have installed *complete Hartley-Turner reproduction.*

The mass production firms may sneer at our "hundreds," but the people who bought our sets are proud of having something to make their friends jealous. Every day, each one of those "hundreds" is bringing us in new business, because no discriminating listener can envisage settling down to listen to ordinary reproduction with any degree of pleasure, after he has heard Hartley-Turner reproduction.

You are too late to buy anything from us before Christmas, but send for our free illustrated literature so that you can start the New Year well.

We shall not be "at home" from December 22nd to 26th.

HARTLEY TURNER RADIO LTD.,

Thornbury Road, Isleworth, Middlesex.

Telephone: HOUnslow 4488.

NUMBERED ADDRESSES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

DEPOSIT SYSTEM.

Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

Receivers and Amplifiers, Etc.—Contd.

EMERSON, the world's finest superhet. 4-, 5- and 6-valve receivers, long, medium, and short wave, all the latest A.V.C. models, just released, first consignment in this country; also 6-valve car radio; send for catalogue.—Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, E.18. [7153

DEGALLIER'S Wish All Their Customers a Happy Christmas and Prosperous New Year and thank you all for past favours; please note: We are closing from Saturday, December 22nd, at 1 p.m., and reopen Thursday, December 27th, at 10 a.m.—Degallier's, 21, Upper Marylebone St., London, W.1. Museum 7795. [7260

7-VALVE Superhet, chassis (by Plessey), made for a well-known proprietary firm whose name we are not allowed to mention, 7 tuned stages, delayed A.V.C., local distance switch, 7-kc. separation, Mullard valves, A.C. 200-250 volts, demonstration daily at 94, High Holborn, chassis complete with Mullard valves, brand new, less speaker and cabinet; £7/10.—Radio Clearance, 94, High Holborn, W.C.1. [7242

FIRST Consignment of the Genuine Emerson 1935 "Round the World" 6-valve Superheterodyne, 19-2,000 metres, 3 separate wavebands, acclaimed by trade as the best all-wave receiver yet produced, aeroplane dial tuning, "Duo-Lite" band switching, dynyamic speaker, automatic volume control, gramophone pick-up, walnut cabinet 16¾in. high, 13¾in. wide.—Write for wholesale catalogue to Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, London, E.18. [7252

ARMSTRONG.—Latest 5v. bandpass superheterodyne chassis, with fully delayed A.V.C., 7 highly efficient tuned circuits, bandpass input, Marconi Heptode frequency changer, combined 1st detector and oscillator, bandpass I.F. coupled to Marconi H.F. pentode, bandpass coupled to Cossor Double Diode, giving distortionless detection and A.V.C., resistance coupled to Mazda high slope pentode, Marconi bi-phase rectifier, full vision illuminated tuning, calibrated in wavelengths, combined radio and gramophone volume control, corrected pentode output, giving exceptionally good reproduction; £6/18/6, with valves, royalties paid.

ARMSTRONG.—5-valve 8-stage superheterodyne chassis, with fully delayed A.V.C., bandpass input, Mullard Octode frequency changer, combined oscillator and first detector, bandpass I.F. coupled to Mullard screened pentode, coupled to Mullard Double Diode Triode, resistance capacity coupled to Mullard 3 watts output pentode, Mullard indirectly heated rectifier, combined radio-gramophone volume control, full aperture drive, calibrated wavelengths. —Massively constructed with the following components. Wearite heavy duty mains transformer, Wearite special coils and I.F. transformers, Polar-ganged condenser and drive, Wearite switching, Hellesen condensers, etc., etc.; price complete, £7/10; this chassis is designed for those requiring slightly more output, particularly on gramophone than our 5v. 7-stage chassis, but it does not supersede this very popular model.

ARMSTRONG.—4v. 3 Pentode radiogram chassis, full bandpass; £5/18/6, with valves.

ARMSTRONG.—4v. Universal radiogram chassis, full bandpass; £5/18/6.

ARMSTRONG Chassis, use highest grade components throughout, are sent 7 days' approval, carriage paid, guaranteed one year.

ARMSTRONG MANUFACTURING Co., 100, King's Rd., Camden Town, London. 'Phone: Gulliver 3105. [7208

"Radio Data Charts," A Series of Abacs Post free 4/10

Receivers and Amplifiers, Etc.—Contd.

£6/18/6.—5 valve superhet. chassis (7-stage), complete with B.R.V.M.A. valves, wired, brand new, ready to switch on; speaker the only extra required; 9 kc. separation; A.V.C. all-British throughout; components by world-famous manufacturers, Polar, T.C.C., Wearite, etc.; 12 months' guarantee; ideal for fitting to existing cabinet, bookcase, etc; have a really up-to-date set for Xmas; A.C. model, £6/18/6; Universal, £7/7; immediate delivery, carriage paid, 7 days' approval, deferred terms if desired; fullest particulars on request.—Westminster Chassis Co., Ltd., 4, Westminster Palace Gardens, London, S.W.1. [7183

MAINS EQUIPMENT.

VORTEXION Specified.

STANDARD A.C.3 Transformer, polished die cast, shrouding guaranteed 5 years; £1; chassis 6/-, choke to match, 12/6.

STANDARD A.C.2 Transformer, 18/-; choke to match 10/6; 5 years' guarantee.

VORTEXION Specified Olympic S.S. 6 Transformer, S.S.352, 5 years' guarantee, 25/-; less terminals and guarantee, 21/-; power chassis, £3/17/6; choke, 12/6; Single Span model, 25/-; power chassis, £3/10.

WHY Not Call and Inspect Complimentary Letters from Customers Who Have Used Them for Many Years?

VORTEXION.—Quality Amplifier or Super Monodial, 425-0-425, 120 m.a., 4v. 6-8a. C.T., 4v. 3a. C.T., 4v. 1a., 4v. 1a super shrouded, core size 2¼in.×1½in., 2½% regulation primary engraved insulated terminals, weight 14lb., 26/-, carriage 2/-; normal shrouded, 22/-; open type, 20/-, post 1/3; speaker field replacement choke, 16/-; special output transformer to "W.W." specification, 12/6, post 9d.; state valve and speaker; "W.W." universal output transformer, £1; normal 40h. 50 m.a. primary output transformers, 10/6, post 9d.

VORTEXION 7.30h. 120 m.a. Choke 215 ohms in die cast shrouding to match; 12/6.

IMITATED but unequalled. Good enough for a "Wireless World" specification is good enough for you.

VORTEXION Cost Little More than the Cheapest, but unequalled by the dearest.

VORTEXION A.C./34, used by author in construction of A.V.C. Three, as illustrated; 18/-.

GUARANTEED 12 Months, and within 5% normal and 2½% super models, neat shrouding, with detachable feet, as used by Government Departments, etc., etc., any model guaranteed 5 years at extra cost of 2/-.

ALL Secondaries Centre Tapped.

VORTEXION.—250-0-250 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., open type, 10/-; shrouded, 12/6; post 9d.

VORTEX.ON.—Ferrocart III 350-0-350, 60 m.a., 4v. 3.5 C.T., 4v. 3.5 C.T.; open type 13/6, shrouded 16/-; post 9d.

VORTEXION Super Model for H.T.8 or 9 or 10. 4v. 1 to 2, 4v. 2 to 4, open type 14/6, shrouded 16/6; post 1/-.

VORTEXION.—350-0-350, 120 m.a., 4v. 2 to 5a., 4v. 2 to 4a., 4v. 2.5a.; open type 14/6, shrouded 16/6; super shrouded model, weight 11lb., 4 filaments to specification, 21/-; post 1/3.

VORTEXION.—400 or 450 or 500v., 120 m.a., 4v. 2 to 5, 4v. 2 to 5, 4v. 2.5a.; open type 19/-, shrouded 23/-.

VORTEXION.—400 or 450 or 500, 150 m.a., 4v. 4a., 4v. 2.5, 4v. 2, 4v. 2, 4v. 2, core size 2¼×1in., a super job 2% regulation 35/-, shrouded, with terminals; less terminals, 30/-; open type, 26/-; post 1/3.

VORTEXION Auto Transformers to B.E.S.A. Specification, 100, 110, or 120, to 200, 220, or 240 volts, 60 watts, 9/-; post 9d.; 120 watts, shrouded 12/6, open type 10/6, post 1/-; 200 watts, shrouded 16/6, post 1/-; 2,000 watts, £4/10.

VORTEXION 1,000-watt Transformers; £4/10, carriage free.

VORTEXION 30h. at 60 m.a., Chokes, 5/6; 40h. at 60 m.a., 8/6; 30h. at 150 m.a., 200 ohms, 10/6 open type, 12/6 shrouded.

VORTEXION Transformers Made to Your Specification; price according to wattage, 6v. filaments same price unless wattage grossly exceeded; special quotations by return.

VORTEXION (S. A. BROWN), 182, The Broadway; works, Stanley Rd., Wimbledon, S.W.19. Tel.: Liberty 2314. [7225

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PARAMOUNT 350-0-350v. 120 m.a., 4v. 2.5a., 4v. 4a., 4v. 5a, open type, 14/-; shrouded, 15/6; post 1/-.

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PARAMOUNT Super Models.—H.T.8, 9 or 10. 4v. 1 to 2a., 4v. 2 to 4a, open type, 14/-; shrouded, 15/6; post 1/-: don't pay high prices for your mains components.

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HOYNE'S.—A.V.C. Straight Four transformer, 18/-, post 1/3; choke, 26 henrys, 120 m.a., 140 ohms, 9/6, post 9d.

HOYNE'S.—250-0-250v. 60 m.a., 4v. 1 to 2a., 4v. 2 to 4a., 10/-, post 9d.; with extra 4v. 1 to 2a. winding, 12/6, post 1/-.

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HOYNE'S.—350-0-350v., 120 m.a., 4v. 2 to 3a., 4v. 4 to 6a., 4v. 1a., 4v. 1a., 18/-, post 1/3.

HOYNE'S.—400 or 450 or 500v., 120 m.a., 4v. 2 to 3a., 4v. 2 to 5a., 4v. 1 to 2a., 18/-, post 1/3.

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HOYNE'S Transformers, built to specifications, keenest prices, best materials and workmanship; quotation by return.

HOYNE'S.—All advertised types from stock.

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MAINS RADIO DEVELOPMENT COMPANY, 4-6, Muswell Hill Rd., London, N.6. [7253

We have endeavoured in this column to bring to your notice some of the more outstanding features of Marconi Valves. If we have helped you the pleasure is ours; but if your problem has not been solved, let us hear of it. We are not omniscient, but will do our best. In the meantime be sure in advance that your Xmas entertainment is secure and satisfactory—fit Marconi Valves, or at least have Marconi spares ready for any emergency.

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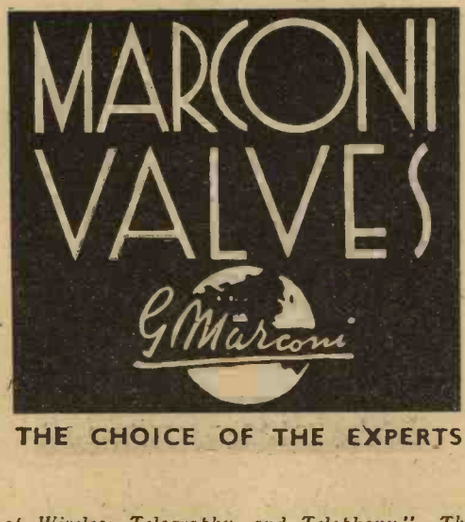

THE CHOICE OF THE EXPERTS

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NEW Ecko K. 25 Eliminators 150v. 20 m.a., with ½ amp. trickle charger, 45/-; Sonochorde 2,500 ohm speakers, with tapped transformer, 10/6; Met-Vick 250v. transformers, 4v. 2a., 4v. 5a. input, 200-250v., with terminals, 11/-, new; Varley Pentode Nichokes, new, 6/-.

T.C.C. 0.1 Non-inductive Tubular Condensers, wire ends, 10d. each; 350 vw. T.C.C., 0.01, mica, type M, 1/-; T.C.C., M type, mica condensers, 0.0001, 0.0002, 0.0005, 0.001, 3d. each; ditto, 0.005, 6d. each; T.C.C. 15 mf. 100 vw. electrolytic, 1/-; T.C.C. 50 mf. 12 vw. electrolytic, 1/-; T.C.C. 0.1×0.1 450 vw., 1/6; T.C.C. 25 mf. 25v., 1/-; T.C.C. 8 mf. Wet Electrolytic, 440 vw., 2/9; T.C.C. 8 mf. dry electrolytic, 500 vw., 3/9; H.M.V. condenser blocks, 4×4×1×1×0.5 250 vw., 3/-, post 9d.; Wego, British, condenser blocks, containing 4×4 mf. at 350 vw. and 1×1×1×0.1×0.1×0.1 at 250 v.w., 4/-, post 9d.

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RYALL'S RADIO Offer Reliable Resistances, suitable for all sets where a 1-watt resistance is specified, in values 100, 150, 250, 300, 400, 500, 600, 1,000, 2,000, 5,000, 10,000, 15,000, 20,000, 25,000, 30,000, 40,000, 50,000, 75,000, 100,000, 150,000, 250,000, ½ meg., 1 meg., 2 meg., all values stated in ohms, 4d. each; also 2-3-watt type, 400, 700, 800, 1,000, 4,000, 5,000, 6,000, 10,000, 20,000, 9d. each, wire ends.

RADIOPHONE Volume Controls with Switch, 5,000, 10,000, 15,000, 20,000, 2/-; also 10,000 graded 9-1 with 3-P switch, 25,000 graded 9-1 with 2-P switch, 3/6.

R. and A. Type Output Transformers, 18-23-32-1, new, 5/-; Paxolin formers, with guides, 1in., 8d.; R.I. Hypermite transformers, 4/, second-hand; R.I. Paraleed transformers, 5/-, second-hand.

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R [7255

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ALL-ELECTRIC 3-stage Amplifiers, 200-250v. 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker; £12/10.

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ALL Premier Guaranteed Mains Transformers Have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; with Westinghouse rectifier, giving 200v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v. 60 m.a. and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a., and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Mains Transformers, output 350-0-350v. 130 m.a., 4v 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt; 10/-.

WESTERN Electric Mains Transformers, 300-0-300v. 65 m.a., 4v., 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a., C.T., 4v. 1a., C.T.; 19/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-110v. or 200-250v., output 180-0-180v., 40 m.a.; 4v. 1 amp., 4v. 3 amps., 4/6; 200-0-200v., 4v. 1a., 4v. 3a.; 4/6.

(This advertisement continued on next page.)

Components, Etc., for Sale.—Contd.

(This advertisement continued from previous page.)

PREMIER L.T Charger Kits, consisting of Premier transformers and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/- complete; ditto, D.C., 47/6.

COLLARO Gramophone Unit, consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job; 15/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-; 200 ohms, wire wound, 1/-.

POLAR Star, manufacturers' model. 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Utility bakelite 2-gang 0.0005, screened, with uniknob trimmer, 3/6; Polar bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

ORMOND Condensers, 0.0005 2-gang semi-shielded, 2/6; brass vanes with trimmers, 3/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna., 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 16/6; 9in. cone, 22/6.

RELIABLE Canned Coils with Circuit Accurately Matched, dual range, iron cored; 2/11.

UTILITY 3-gang Condensers, 0.0005, fully screened, with trimmers, ball bearing, straight or superhet., 6/9; complete; with disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-; 2 mf., 750v. working, 3/-.

VARLEY Constant Square Peak Coils, band-pass type B.P.7, brand new, in maker's cartons, with instruction and diagram: 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instructions, in original cartons; 2/6.

SCREENED H.F. Chokes, by one of the largest manufacturers in the country; 1/6.

PREMIER British-Made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000 500,000, 2/- each; 1,000 ohm, semi variable, carry 150 m.a., 2/-.

PLESSEY Pick-up and Arm, 15/-; Cosmocord pick-up, with arm and volume control, 10/6.

RELIABLE Intervalve Transformers, 2/-; M.C. Multi-ratio output transformers, 2/6; 2-1 or 1-1 output transformers, 2/6; microphone transformers, 50 and 100-1, 2/6.

MAGNAVOX Super 66 Power, pentode and push-pull transformer, 2,000 ohm field, £4/4; energised for 200/250 A.C., £5.

BLUE SPOT 45 P.M. Speaker Multi-ratio Transformer, handles 4 watts; listed 45/-, at 25/-; or in handsome walnut cabinet, 35/-.

BLUE SPOT 99 P.M. Speaker Multi-ratio Transformer, handles 5 watts; listed 59/6, at 31/-.

SUPER Moving Coil Speaker by World Famous Radio and Gramophone Co., 10,000 ohm field (300v. 30 m.a.); 25/-; handles 10 watts.

PREMIER H.T.11 Transformer, 500v. 120 m.a., or 450v. 150 m.a., rectified, with 3 L.T. windings, 22/6; with Westinghouse rectifier, 42/6.

DARIO Valves, 4 volt battery type, H.F., R.C., L.F., power, 1/6 each; 4v. directly heated mains power, 1 watt, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers at a fraction of original cost; send for list.

THE Following Lines 6d. each, or 5/- Per Dozen: Chassis valve holders, 5-, 6-, or 7-pin screened screen-grid leads, any value 1-watt wire resistances, wire end condensers, 0.0001 to 0.1, 3 amp. main switches, Cyldon capacitors, double trimmers.

SCOTT Aerial and Anode Coils, dual range, complete with circuit; 2/6 per pair.

BLUE SPOT 29 D.C. Moving Coil, with multi-ratio transformer, 7in. cone, 2,500 ohms, 9/11.

ELPHRO Volume Controls, 10,000, 12,000 or 15,000 ohms, complete with mains switch; 1/-.

T.C.C. Electrolytic Condensers, 8 mf., 440v. working 3/-; 4 mf., 440v. working, 3/-; 15 mf., 50v. working, 1/-; 50 mf., 12v. working 1/-; 15 mf., 100v. working, 1/3; 6 mf., 50v. working, 6d.; 2 mf., 100v. working, 6d.; 8+4 mf., 450v. working, 4/-.

DUBILIER Dry Electrolytic Condensers, 12 mf., 20v. working, 6d.; 50 mf., 50v. working, 1/9.

CONDENSER Blocks, H.M.V., 400v. working, 4+2+1+1+1+0.5, 3/9; 2+2+1+1+1+0.5, 3/-; Dubilier 300v. working, 4+4+2+0.1, 3/-; Philips 6+4+2+1+1, 4/6.

RADIOPHONE Logarithmic Wire Wound Potentiometer, 10,000 ohms, with mains switch, 2/-; S.W. H.F. chokes, 10-200 metres, 9d.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World-famous Continental Valve Manufacturer, all the following standard mains types, fully guaranteed, 4/6 each; H.L., L., power, medium, high, low mag. and variable mu screen grids, 1-, 3- and 4-watt A.C. output, directly heated pentodes, 250v. 60 m.a., full wave rectifiers, D.C. types, 20v. 18 amps., filaments, screen grid V.M., H., H.L., power.

THE Following Types, 5/6 each: 350v., 120 m.a., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½-watt indirectly heated pentode.

THE Following American Types, 4/6: 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27.

THE Following Types, 6/6 each: 42, 77, 78, 25Z5, 36, 1, 33, 83, 39, 44, 53, 6B7, 2A5, 2A6, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for catalogue of above types.

PREMIER SUPPLY STORES,

220-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest Station: Clapham North (Underground). [7240

SOUND SALES

Faultless Reproduction

Faultless Reproduction at Christmas and for years after is the best we can wish our numerous friends.

We do not like spoiling the atmosphere at Christmas with commonplace business advertisements, but we cannot resist referring you to the "WIRELESS WORLD" test report on our 4-12 watt Quality Amplifier, extracts as follows:—

. . . . the quality of reproduction on test reached such a high standard that it would be difficult to find any fault with it . . . .

. . . . the freedom from amplitude distortion being most noticeable . . . .

Frequency response is very satisfactory, the loss of 20 cycles and 10,000 being less than one D.B. . . . . should give years of trouble-free operation.

Our wish for a Merry Christmas still applies even if you are not a fortunate possessor of the Sound Amplifier, but we can at least interest you with our latest catalogue and the details of our well-known mains transformers and chokes.

SOUND SALES LTD.,

Contractors to the G.P.O., etc.

TREMLETT GROVE, JUNCTION ROAD, LONDON, N.19. *Telephone: Archway 1661/2.*

50 ohms to 100,000

WIRE-WOUND RESISTORS

A DEFECTIVE Resistance can completely ruin the enjoyment of radio—and frequently does. Moreover, it is often difficult to trace the fault, as none but the most expensive testing equipment can definitely locate it.

When building your next set, or overhauling your present equipment, change over to Amplion resistors. They are colour coded, compact and sturdy, and all values are *wire-wound*, this method of construction giving the most reliable and constant form of resistance.

PRICE EACH 1/- ALL VALUES

AMPLION

1-WATT WIRE-WOUND RESISTORS

Obtainable from all Dealers.

AMPLION (1932) LTD.

82-84 Rosoman Street, Rosebery Avenue, London, E.C.1

Components, Etc., for Sale.—Contd.

TELSEN Components; sensational offer by

OLYMPIA RADIO, Ltd.

TELSEN Matched Screened Coils, suitable for use as aerial or anode coils; can be embodied in any circuit; list price 7/-, our price 4/11.

TELSEN Band-Pass Coil Unit, comprising pair of accurately matched screened band-pass coils, complete with wave-change switch, escutcheon and knobs; list price 14/6; our price 8/11, per set.

SET of Telsen Band-Pass Screened Oscillator Coil Units, comprising band-pass coils and oscillator coil, complete with wave change switch, for single knob control; list price 21/6, our price 8/11, per set.

TELSEN Set of Triple Matched Screened Coils, suitable for aerial and 2 H.F. stages, or can be embodied in practically every modern circuit; list price 21/6, our price 12/11 per set.

TELSEN 'Radio-Grand Transformers, 3-1 ratio only; list price 7/6; our price 4/3.

TELSEN Ace Transformers, 3-1 and 5-1; list price 5/6 each, our price 3/9 each.

TELSEN D.C. H.T. Units, 200-250v. input, output 28 m.a. at 150 volts, 3 tappings; list price 25/6, our price 15/6.

MARCONI 2-valve Battery Receiver, complete with valves and all batteries, self contained cabinet; list price 4 guineas, our price £2/2/6.

LISSEN 2-valve A.C. Receiver, absolutely complete in handsome Bakelite cabinet; list price 8 guineas, our price £2/19/6.

ATLAS P.M. Speakers, one of the finest moving coils made, complete with transformer, suitable for pentode or power valve; list price 42/6, our price 14/11.

ATLAS T.12 Eliminators, output 120v. 12 m.a., complete with trickle charger; list price 77/6, our price 45/-.

TELSEN—More Components.

L.F. Coupling Units, 4/6; L.F. smoothing chokes, 3/11; tapped pentode output chokes, 3/6; Class "B" output transformers, 4/3; 313 disc drive, 2/3; air dielectric 0.0005 condensers, 1/11; Bakelite dielectric tuning condensers, 0.0003 only, 1/-; shortwave H.F. chokes, 1/9; binocular H.F. chokes, 3/6; etc., etc.

THE Above Receivers are Mostly Brand New Decontrolled Models; we have large numbers as slightly shop soiled or second-hand models in addition; illustrated lists post free on application; also numerous other bargains in speakers, eliminators and components.

TERMS—Cash with Order or c.o.d.

ALL Goods Carriage Paid; everything guaranteed O.K., money refunded if not satisfactory; please mention this paper when replying.

RE Telsen:—All goods carriage paid excepting transformers and chokes, for which please send 6d. extra owing to the heavy nature of the goods.

OLYMPIA RADIO, Ltd., Mail Order Dept., 49a, Shudehill, Manchester.

BRANCHES in All Principal Towns. [7265

SOUTHERN RADIO'S Wireless Bargains.

RECEIVERS.—G.E.C. Osram 4-valve (actual) sets, complete with 4 Osram valves, permanent magnet moving coil speaker, magnificent pedestal cabinet, ready to use on all voltages A.C., all Osram proprietary components in original sealed cartons; £6/15 (list £15/15); an exceptional bargain.

CROMWELL 3-valve Battery Sets, complete with three Cossor valves, permanent magnet moving coil speaker in magnificent walnut console cabinet, brand new, in original sealed cartons; £3/12/6 (list £8).

BURGOYNE Class "B" Receivers, 1935 series, brand new, in original sealed cartons, complete with 3 Mullard valves, Exide batteries and accumulator. P.M. moving coil speaker, contained in attractive cabinet, magnificently finished with chromium fittings; £3/19/6. (list £6/10).

LISSEN 2-valve D.C. Receivers, complete with valves, speaker in attractive bakelite cabinet, ready to work on all voltages D.C.: £2/19/6 (list £7/7).

COILS.—Igranic superhet, set of four (1 Osc., 2 L.F. with pigtails, 1 L.F. plain), 12/6 (list 50/-); Lissen superhet, 3-coil kit, screened, ganged on base with switch, type L.N.5181, 9/6; same description for band pass or any straight circuit, type L.N.5162, 7/-; Varley constant square peak coils, B.P.5, complete with all accessories in sealed cartons, 2/3; Lewcos, O.S.C./126 (extensor) T.O.S./R. all at 3/6 each.

PICK-UPS.—Marconi model K.25 (1935 issue), 21/- (list 32/6).

CONDENSERS.—Lotus 3-gang, 12/6; 2-gang, 8/6; all 0.0005, fully screened with trimmers, complete with dials, knobs and escutcheons; special bargain line, Plessey 4-gang condensers, superhet. type, fully screened with trimmers (less dials) (standard dial will fit), 10/6 (list 45/-); Dubilier block condensers, 4 mfd. (2×1×1), 1,000v., 2/9; 4.5 mfd. (2.25×2.25), 3/-; T.C.C. (0.1×0.01), 1/3 each.

SPEAKERS.—Blue Spot 66R. units, brand new and boxed, 10/6 (list 35/-); complete, mounted on Blue Spot chassis, 16/6 (list 45/-).

BLUE Spot Permanent Magnet Moving Coil Speakers, universal transformer for Class "B," Super Power, Power, or Pentode, all brand new 1935 series, in sealed cartons; type 45P.M., 26/- (list 45/-); 99P.M., 30/- (list 59/6); 62P.M., in magnificent cabinet, 38/- (list 67/6); 32P.M., in exquisitely finished cabinet, 45/- (list 87/6), all brand new.

MISCELLANEOUS.—Set manufacturer's surplus skeleton type Westinghouse metal rectifiers, H.T.6, 7, 8, 9/3; morse tapping keys with flash signal and buzzer, complete with battery and bulb, 2/-; Lissen general purpose output chokes, 20-28 henries, 18-60 m.a., L.N. 5301, 6/- each; Lewcos superhet, dual wave frame aerials, 9/-; utility midget condensers 0.0005, complete with dial, knob escutcheon, 2/6; Bifo static cutouts, definitely cuts out all electrical interference and all unwanted noises without decreasing volume, listed at 12/6, our price 2/3 each; brand new and boxed, with simple instruction leaflet; please state whether A.C., D.C., or battery set; note price, 2/3 (listed 12/6).

THOUSANDS of Bargains for Callers at our Various Shops.

ALL Goods Guaranteed and Sent Post Paid.

BRANCHES at 46, Lisle St., W.C.2; 16, Leicester St., W.; 271-275, High Rd., Willesden Green, N.W.10; all mail orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324. [7224

"Handbook of Technical Instruction for Wireless Telegraphists" Fifth Edition Post free 15/9

Components, Etc., for Sale.—Contd.

ANDERSON.

A LARGE Selection of Surplus Parts for Sale at Keen Prices, including Ferranti meters, transformers, also some first class speakers, at various prices; sets and all various parts; send for price list, and your requirements.—J. F. Anderson, 35, Landsdowne Rd., Walthamstow, E.17. [7213

WOBURN RADIO Offer Following Bankrupt Stock and Manufacturers' Surplus:—

BRITISH Radiophone two-gang Condensers, .0005, with trimmers unscreened, 5/9; Radiophone three-gang condensers, .0005, fully screened with trimmers, straight and super-het, 9/9.

ROTHERMEL Piezo Electric Pick-ups, new 2 guinea model, boxed, 30/-; Marconi K.25 pick-ups, 21/-; Western Electric microphones, 2/3; microphone transformers for same (ratio 85/1), 2/3.

WESTINGHOUSE Rectifiers, set manufacturers' surplus, skeleton type, H.T.8 and 9, 8/11; few only H.T.5 and 6, 4/9; transformers for H.T.8 and 9, with L.T. winding, 4v. 4a., C.T., 6/9; screened flex, 3d. yd.; toggles, 6d.; chassis valve holders, 4-5-pin, 1/3 half dozen, 7-pin, 6d.

ESTON Iron Cored Coils, 2/6; Lucerne iron cored canned coils, 2/6; Columbia 3/1 and 5/1 L.F. transformers, 2/9; Class B driver and choke, 8/6 per pair; with valve and 7-pin holder, 17/-; binocular chokes, 1/2; H.F. chokes, honeycomb wound, 10d.; Sistoflex, 7yds., 6d.; J.B. condensers, .0005 air spaced, with dial, escutcheon and lamp, 3/3; Rothermel Midget P.M. speakers, 5in. cone, 12/6.

CONDENSERS.—All blocks as last week; Formo 1 mfd., 1/-; 2 mfd., 1/3; 4 mfd., 2/3; T.C.C. electrolytics, 6 mfd., 50v. working, 15 mfd. 100v. working, 25 mfd., 25v. working, and 50 mfd. 12v. working, all at 1/3; British insulated cables, dry electrolytics, 8 mfd. 550v. working, 3/-; 50 mfd. 50v. working, 3/-; Dubilier 4 mfd. 500v., 3/-; 8 mfd. 530v., 3/-; 50 mfd. 50v., 3/-; T.C.C. tag condensers, types "S" and "M," .001, .0015, .003, .006, .0001, .0002, up to .0009, and .00005, 4d. each; tubular condensers, Wego .01, .02 and .1, 6d.; Wego .25, 9d.

WOBURN Trickle Chargers, 2v., 4v., 6v. 5 amp., 12/6, carriage 1/-.

NEW Trade List Now Ready; send heading and stamp.

TO Avoid Delay Send Orders Without Money; we pay c.o.d. fees on orders over 5/-.

WOBURN RADIO Co., 9, Sandland St., Red Lion St., Holborn, W.C.1. Holborn 7289. [7239

MILDMAY RADIO EXCHANGE Offers the Following, sound and perfect, cash with order or c.o.d.

1935 Ultra Model 22, for D.C. mains, complete with valves, and in sound and guaranteed working order, demonstration model; £8/8.

BELMONT Midget Receiver, A.C. or D.C., complete with valves, £4/10; Lotus 3-valve battery operated receiver, complete with valves and speaker in self-contained cabinet, S.G., det., power, £3/5.

COLLARO Type 32 Combined A.C. Mains Gramophone Motors, complete with pick-up and volume control, fitted with fully automatic stop and start, 12in. turntable; 50/- each, listed £4.

SPECIAL Offer: Telsen L.F. chokes, 40 henry, brand new and in sealed boxes; 1/6 each; limited number only.

SPECIAL Offer: Telsen short-wave coil units, brand new and in sealed boxes; 1/9 each.

J.B. Unitune 3-gang 0.0005 Variable Condensers, fully screened, with trimmers and complete with drive, in sealed boxes; 11/6 each.

FERRANTI A.F.4, 7/6; A.F.3, 10/-; A.F.5, 18/-; A.F.6, 18/-; A.F.7, 18/6; B1 choke, 10/-; B2 choke, 12/-; B3, 5/-; B5 choke, 15/-.

FERRANTI Output Transformers: O.P.1, 1-1 ratio, 7/6; O.P.2, 25-1 ratio, 7/6; O.P.3C., 1-1 P.P. output, 8/6; O.P.M.1, 10/-; O.P.M.2, 10/-; O.P.M.3, 10/-; O.P.M.5, 10/-.

METERS.—Ferranti 3-range voltmeter, 0-10, 0-50, 0-250, 22/6; Ferranti triple range, 0-7.5 volt, 0-150 volt, 0-15 m.a., 22/6; Ferranti 0-100 m.a., 18/-; Hunt's Dead Beat M.C., 0-50 m.a., 15/-; Avominor, 27/6.

VARLEY B.P.31 Coils, 6/- each; Ferrocart G10, G14, G18, 22/-; set 3 Colvern K.G.O. coils, 16/-; set Varlet Nicore coils, 2B.P.30, 1B.P.41, 17/6; Wearite and Lewcos superhet coils, 4/- each.

WRIGHT Da Coster Senior Type A.C. Mains Moving Coil Speaker, will handle 10 watts, complete with matching transformer, £4; Baker's P.M. moving coil speaker, £3/15 model, 37/6; Epoch model D2S 13in. cone, £2/12/6.

MARCONI K17 Square Head Pick-ups, 18/6 each; Burndept needle armature pick-up, 18/-; pair Multitone Class B transformers, 9/6; pair R.I. Q. P.P. transformers, 15/- pair; Varley B.P.42 coils, 14/-.

LOTUS All-power Units, 2 only, giving H.T., L.T., and G.B., 22/6 each; 2 only Tannoy all-power units, as per Lotus, 20/- each.

THE Above Post or Carriage Paid.

WE are Open All Day Thursday, and until 9 o'clock on Saturdays.

PHONE: Terminus 6751.

6, Pentonville Rd. (near The Angel), London, N.1 (2 minutes from King's Cross and Euston). Callers invited. [7201

MARCONI P13 60-watt A.C. Amplier, complete with valves, £8/10; ditto 30-watt, complete with valves, £5/10.

AMPLION Output Amplifiers, 110-240v. A.C., Westinghouse metal rectifier, supplying H.T. meter in output stage, using one L.S.6A; breaking up price, less valves, £2/5.

SYMPLAPHONE Taltin A.C. Amplifier, Parmeko components, Weston meters, D.O.60 in output stage, complete with valves, etc.; £12/10.

CELESTION P.P.M. 10½in. Cone, complete with universal output transformer, list 77/6, my price, brand new, 35/-; P.P.M.79, in oak, walnut or mahogany cabinets, list £6/6, my price, in original cartons, 45/-.

CELESTION Energised Speakers and Other Makes, 450 and 2,000 ohms; 8/6 each.

CLAUDE LYONS Straight Line 4-gang Condensers, 0.0005, list 28/-, my price, new and boxed, 5/6 each.

INSTAMAT Output Transformers, giving 1: 2, 1: 1, 1½: 1, 2: 1, 3: 1; 5/11 each.

TALKIE Equipments.—Sound heads, meters, amplifiers, components, etc., at knock-out prices, callers invited; stamp for lists; terms, cash with order, c.o.d. carriage forward.—H. Franks, 23, Percy St., Tottenham Court Rd., W.1. Museum 8585. [7226

Christmas is nearly here

Just time enough for you to get your

EPOCH
REPRODUCER

We are at your service until Christmas Eve. If your dealer is sold out, 'phone us direct. Our Works and Despatch Department will be open on **Saturday, Sunday and Monday** for urgent speaker orders and set repairs.

Make your choice
from the following:

Twentieth Century P.M. Model
A speaker ideal for any type of set. Handles from one-tenth to 4 watts comfortably.
Type 20C.—Unit with 5-ratio transformer, £1.15.0
Type 20C.C.—In Polished Walnut Cabinet £2.7.6

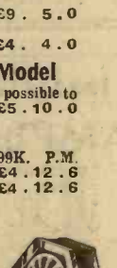
A2½ P.M. Model
A new hand-made, quality model of outstanding appeal at a reasonable price.
Type A2½.—Unit with 10-ratio matching panel, £3.3.0
Type A2½C.—In handsome Mahogany, Walnut or Oak Cabinet. £4.8.0

Domino—Energised Model
Designed for those who insist upon Quality. The most sensitive domestic speaker obtainable.
Type 101½E.—Unit for 4-12 volts £5.15.0
Type 101½F.—Unit for D.C. mains £6.15.0
Type 101½J.—A new unit for A.C. and D.C. by a quick change-over device - - - - £9.5.0
Handsome Walnut, Oak or Mahogany Cabinet, extra - £4.4.0

99K. (De Luxe) P.M. Model
As near perfect reproduction as is possible to obtain at present. Price £5.10.0

99½—Energised Model
Identical in quality to the 99K. P.M.
Type 99½E.—4-12 volts - - £4.12.6
Type 99½F.—For D.C. mains - £4.12.6

MOVING COIL MICROPHONE



EPOCH Microphones should not be confused with the more popular and apparently inexpensive types. They are a great advance over Carbon and Condenser types, having much greater sensitivity. The quality is perfect at ALL frequencies. Being designed for serious work there is an entire freedom from distortion and from external and internal noises.
Type 44. As illustrated. £4.4.0
With input transformer £5.5.0
Floor Stand, Extra £1.1.0

FREE. Upon application fully illustrated catalogue will be sent by return.

SERVICE. Send your problems to our Technical Enquiry Bureau. We shall be glad to help you.

SET REPAIRS Our fully equipped Workshops and Test Laboratories are at your disposal. All service work is carried out by fully qualified engineers. Write or 'phone for details.

Trade Enquiries invited.

EPOCH
REPRODUCERS & MICROPHONES
Made and Distributed by
THE RADIO DEVELOPMENT CO.
Aldwych House, Aldwych, LONDON, W.C.2
Telephone: Holborn 9111

Components, Etc., for Sale.—Contd.

WARD for Unparalleled Bargains in Set Manufacturers' Surplus; all goods are guaranteed perfect; immediate delivery.

OLYMPIC S.S. Six Coils, complete to specification, 45/-; A.C. and D.C. eliminators, first class make, tappings S.G., detector and power (150v., 25 m.a.); A.C. type with Westinghouse rectification, 25/-; D.C. type 12/-.

DUBILIER Resistances, 1-watt type 7d., 2-watt type 1/2, 3-watt type 1/9, Dubilier or T.C.C dry electrolytic condensers, 8 mfds or 4 mfds, 500v. peak, 50v., 50 mfds, or 200 mfds, 10v. peak, 3/6.

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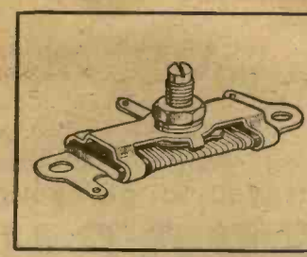

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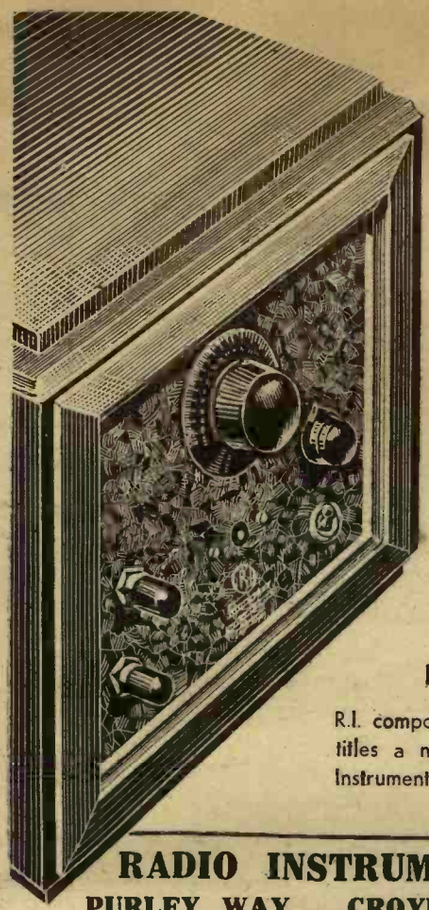

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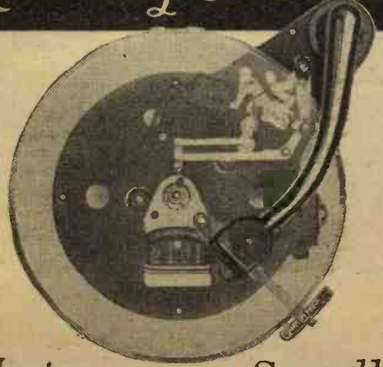

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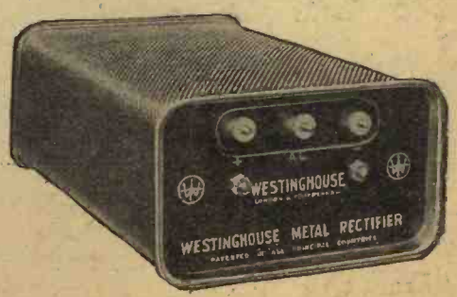

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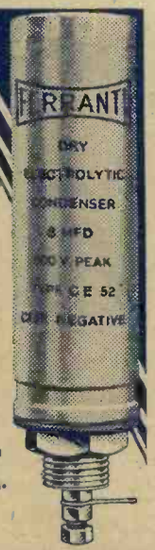

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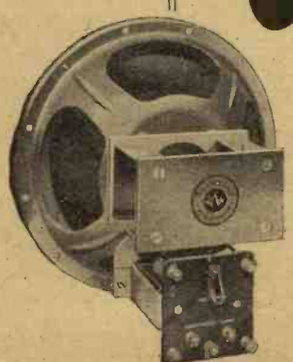

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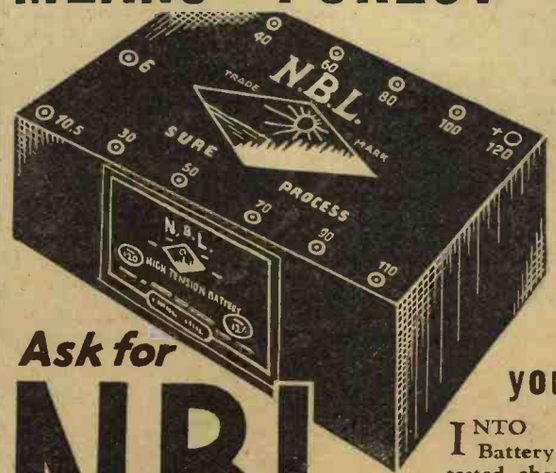

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24th Year of Publication

No. 800. FRIDAY, DECEMBER 28TH, 1934. VOL. XXXV. No. 26.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.
Telegrams: "Autocar, Coventry" Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Television

A Forecast of Developments

BY the time that this issue appears we anticipate that the Postmaster-General will have received the report on television prepared by the Committee which he appointed at the beginning of the year, and whilst great secrecy is being observed, it is nevertheless possible to form some conclusions as to what the report is likely to contain.

Enough has already been disclosed to indicate that the Committee's investigations have been concentrated upon systems of television enabling much greater definition to be attained than has been possible under the 30-line transmissions available up to the present. With high definition television the early stages of a service must therefore be local in character.

It is most unlikely, we think, that the Committee would recommend that anything but active encouragement should be given to television progress.

We know that the Committee have visited the United States of America and Germany to view systems in operation there, and have also investigated various television systems in process of development in this country. Our own knowledge of these systems leads us to believe that America and Germany, although they are contributing largely to television technique, are not actually ahead of us in practical development. It seems safe therefore to suppose that any system recommended will be one which is being worked in this country.

Next we come to a consideration of what authority will be given the task of conducting the actual transmissions, and here the answer seems to us to be obvious. The B.B.C. has at present the monopoly for the transmission of sound in broadcasting, and television without sound is only half complete. We must also remember that the 30-line television service at present running, although a Baird system, has been operated by the B.B.C. It can, therefore, be taken almost for granted that the B.B.C. will get the job.

There are rival systems of television in this country, and it may be thought at first that, in order to be fair, it would be necessary to give each of these systems an opportunity to be tried out, but if we investigate a little farther this seems to be an unnecessary complication. When sound broadcasting was started in this country there were rival manufacturers of transmitting apparatus all anxious to erect their own stations and conduct broadcasting, but through the wise guidance of the Post Office these companies agreed to pool their patents and co-operate. If such a course was desirable in the case of sound broadcasting, it is even more so with television, where different systems of transmission might necessitate different types of receiver.

No Monopoly

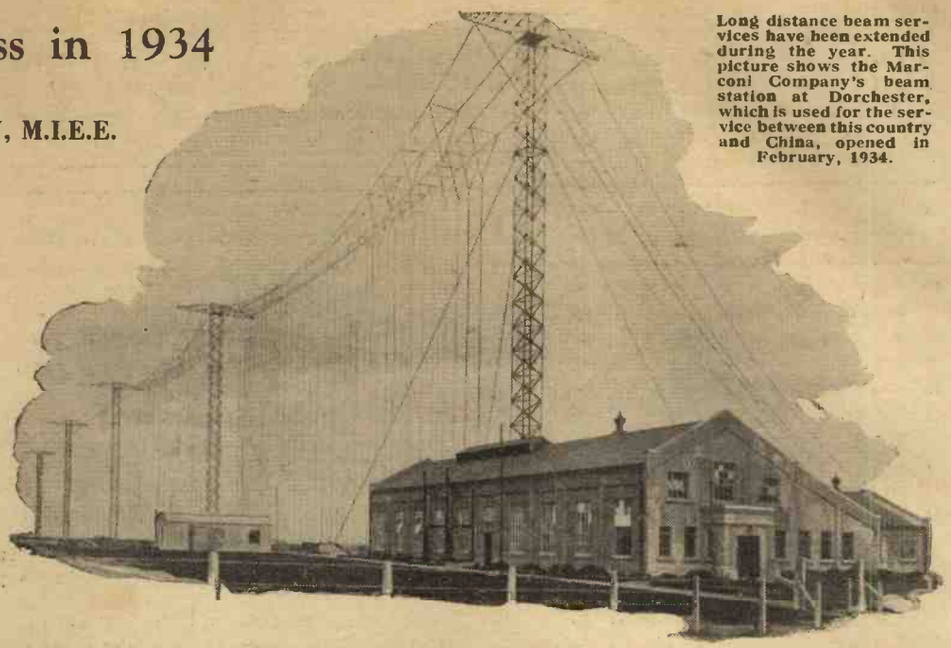
As regards the receiving side, readers may recollect that we have repeatedly emphasised the view that licences should be granted by holders of patents on reasonable terms to any *bona fide* manufacturer in the industry so as to avoid any commercial monopoly. This requirement, which was acceptable in the early stages of broadcast development, would again necessitate that rival companies in this country should get together and adopt a joint licensing scheme for manufacturers for television receiving sets.

This brief summary of the position must, we believe, provide a fairly accurate forecast of the recommendations which will go forward to the Postmaster-General.

Advances in Commercial Wireless

The March of Progress in 1934

By LT.-COL. CHETWODE CRAWLEY, M.I.E.E.



Long distance beam services have been extended during the year. This picture shows the Marconi Company's beam station at Dorchester, which is used for the service between this country and China, opened in February, 1934.

IMPORTANT achievements in short-wave working, in picture transmission, and in the use of radio on sea and in air provide the material for this interesting chronicle of the year's activities. The cathode ray tube has now taken its place among radio safety appliances, which also include new direction-finding instruments and "homing" devices on aircraft.

THE most spectacular achievement in wireless communication during the year passed almost unnoticed at the time, owing to the far more spectacular event which it recorded—the triumphal arrival of the airmen, Mr. Scott and Mr. Black, in Australia. It was the first news-reel film transmitted by wireless for public exhibition, and was shown in London on the night of the 27th of October.

The total time of transmission from Melbourne to London beat the airmen's time for the outward journey by only a few hours, and it cost £6,240, nearly the price of their aeroplane. For transmission, each separate picture, of which twenty-four were projected in a second, had to be enlarged to 6 by 8 inches and transmitted separately over the beam wireless and cable circuits of Cable and Wireless, Ltd., being re-photographed for film purposes on arrival in England. The film, which lasts only seven seconds, shows Mr. Scott, Mr. Edwards, Miss Batten, and Mr. Black, who is in the act of drinking a glass of beer.

This picture telegraph circuit, the longest in the world, was formally opened on October 17th, and is now available for the transmission of pictures, drawings, balance sheets and the like. Under good conditions a quarter-plate picture can be sent from London to Melbourne in about half an hour. The Company has, of course, operated a similar picture service across the Atlantic for several years, and the Post Office provides wire services of the same kind with ten Continental countries. The average charge for these comparatively short-wire services is only about 3d. a square centimetre compared with 3s. 3d. for the new Australian service.

Picture transmission has made strides. Pictures and newspaper cuttings are here seen affixed to cylinders ready for transmission.

In February a short wave beam telegraph service was opened by Cable and Wireless, Ltd., between this country and China. This is the first direct wireless service between the two countries. The Chinese station, which is at Chenju, near Shanghai, is equipped with the Marconi Company's apparatus purchased by funds from the British Boxer indemnity. The service in England is conducted from the Company's stations at Dorchester and Somerton, and the rates are the same as by cable, full rate 2s. 9d. a word.

In August the same company received an order from the Brazilian Government for a network of telegraph and telephone services throughout Brazil on behalf of the Brazilian Post Office, which will operate the stations. The first of these is to be ready next June.

Long-range Telephony

Early in the year it was announced that on Saturdays half rates only would be charged for calls between this country and Australia, South Africa and India, i.e., £1 a minute with a minimum of three minutes. In February a service was opened between San Francisco and Java, and a service was made available between England and Columbia via New York at a rate of £7 16s. for three minutes. The Australian service was extended in April to Perth in W. Australia at the same rates as other places in Australia, and in May the India service was similarly extended to many places in India.

In June a service was opened between Japan and Formosa, and the England-Egypt service was extended to all the principal towns in Egypt at a rate of

£3 12s. A month later the Palestine service was extended to Bethlehem, amongst other places, at a rate of £3 18s., and in October it was extended to all places in Palestine served by telephone. In October, too, a service was opened between Japan and Batavia, and the Manchukuo-Manilla service was extended to Java. In December a service was opened between the U.S.A. and Japan.

The phenomenal growth of long-range telephone services since the opening in 1927 of the pioneer transatlantic circuit will be realised from the fact that we are now connected by telephone to thirty-seven countries outside Europe. Twenty-two of these countries can be connected to practically all European countries, and many of them can be linked up for intercommunication through London. Since the first year the traffic has increased more than tenfold. The various liners which work with this country can also be connected through London with the Dominions, India, Egypt and Palestine, as well as with most European countries.

Ship Services

The traffic between the shore and ships has shown a considerable increase this year, due, to some extent, to the slight improvement in shipping generally, but mostly to the increased facilities for sending Ship Letter Telegrams (S.L.Ts) from ships, and to the increase in the number of fishing craft fitted with telephony. It is now permissible to send S.L.Ts. from ships to Portishead Radio on short waves from any part of the world. Twenty words can be sent for 5s., and thus a remarkably cheap and efficient service has been formed, as the only delay incurred is that the messages are forwarded to the addressee from Portishead Radio by ordinary post instead of by telegram, as in the case of the fully paid service at 11d. a word.

There has been a good deal of improvement in directional equipment for ships during the last twelve months, stimulated by the fact that after this year all passenger ships of 5,000 tons or over will be compelled by law to carry D.F. gear.

An interesting demonstration was given in July by Marchese Marconi at Genoa of a new type of micro-wave beacon by which a ship can be steered on a straight line through a harbour entrance even in the very worst conditions of visibility. The shore transmitter sends out two comparatively wide beams arranged so that there is a narrow zone of silence between them. These beams oscillate slowly on either side of the centre line of the harbour channel. If the ship is on the correct course the change of note takes place as the zone of silence is swinging across her. If not, the change in note takes place without a silence break, and is quite perceptible. Also, one note is heard more strongly than the other. Thus the navigator can tell on which side of the correct line he is situated.

Another interesting aid to navigation, which was demonstrated by the Department of Scientific and Industrial Research, is the Cathode Ray Collision Preventer. In this instrument the signals received on each of the loops of a multi-turn crossed loop aerial, after amplification through identically similar receivers, are fed to one or other of opposite pairs of four deflecting electrodes at right angles to one another in a cathode ray tube. The direction in which the spot of light on the screen of the tube is deflected therefore depends on the relative intensities of the signals received on each loop, that is, it indicates the direction from which the signals are being received.

The sending ship sends dots of about one hundredth of a second on a 600 metres wave at intervals of about ten seconds, so producing a bright line on the screen of the receiving ship every ten seconds. The direction of the line shows the direction of the sending ship, and the variations in the length of the line show the changes in the distances between the ships.

Trawlers are now fitted with fool-proof radio telephony sets. Here is a Siemens Co.'s installation in use.

New directional equipment produced during the year by the Marconi Company included a D.F. set for submarines by which bearings can be taken in the usual way even when the vessel is submerged.

On shore, the accuracy of bearings taken by a D.F. station are much affected by the site of the station. For instance, the Post Office station at Niton, in the Isle of Wight, is situated on the edge of a cliff, and is rather shut in by other buildings, so that hitherto it has been able to take accurate bearings from ships over an arc of only 110 degrees. During the year, however, experiments have been carried out with arrangements by which it has been found possible to utilise directional aerials erected at a more suitable site about half a mile from the station, and by this means the arc of accuracy has been doubled.

Short-range Telephony

The telephony service with large ships that are suitably fitted, which has never had a fair chance to develop owing to the shipping slump, has shown about a 40 per cent. increase in calls compared with last year. A dozen liners on the North Atlantic route are now fitted with equipment suitable for taking part in this service, which continues to be extended to various countries.

The short-range telephony service with fishing and other small craft continues to expand, and about 500 British small craft are now fitted with telephony. Wick Radio, in the North of Scotland, deals with about half of this traffic.

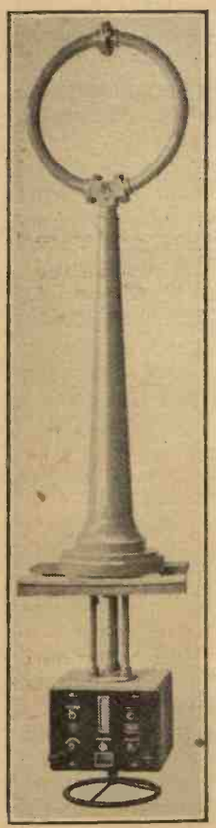
A Marconi short-wave wireless telephone receiver in operation on the "Empress of Britain."

Advances in Commercial Wireless—

So far, the aircraft services in this country are what might be called safety services, no traffic services being yet in operation, and indeed there would not appear to be much scope for commercial traffic with aircraft in a country where flights are as short as they must be here. On the other hand, this does not apply to Empire flights, and commercial traffic will soon be developed on these long-distance journeys.

Ultra-short Waves

The micro-ray link between the civil airport at Lympne, in Kent, and St. Inglevert, in France, was formally opened on January 26th. This service, which is jointly provided and operated by the British and French Air Ministries, replaces the slower service, by which messages were sent by land line between Lympne and Croydon, and by wireless telegraphy between Croydon and St. Inglevert. The wavelengths were slightly staggered at about 17 cms., the shortest wave yet used for any established service. Tests to permit of duplex working taking place simultaneously by teleprinter and telephone are in progress on a 29-metre wave. The transmission is concentrated into a fine pencil of rays by aluminium reflectors 10ft. in diameter, similar reflectors being used at the receiving end.



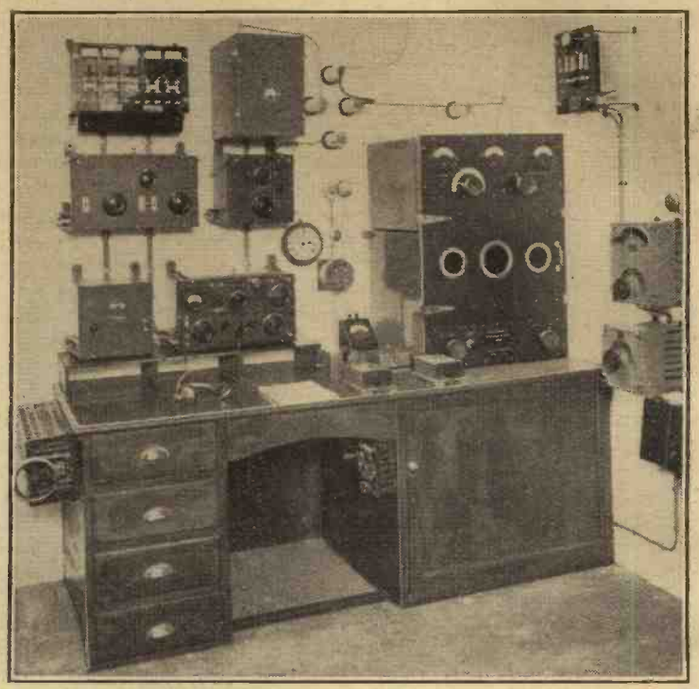
DF receivers are now in common use. This is the International Marine Radio Company's instrument.

During the year a good deal of experimental work has been carried out at Croydon with beam systems for guiding aircraft, and a D.F. equipment of the Marconi - Adcock type has been installed at Lympne. The aerodromes at Hull, Portsmouth, and Belfast have been equipped with up-to-date wireless stations suitable for telegraph or telephone operation, and fitted with directional receivers. The Marconi Company's transmitters fitted at these stations have a power of 500 watts on the valve anodes on C.W. telegraphy, and are arranged for quick wave-changing and remote control. The whole apparatus is designed for mobile use, and can be accommodated on a motor lorry. Five more of these semi-mobile stations are under construction, and arrangements, too, are being made to link up aerodromes by teleprinter working. The circuit between Liverpool and Manchester is already in operation. The Air Ministry therefore now controls in this country a comprehensive system of communications for civil aircraft, with the stations at Croydon, Heston, Lympne, Pulham, Manchester, Hull, Portsmouth, and Belfast.

Some experiments with ultra-short waves have been carried out during the year in aircraft, and in September these waves were used to communicate with a glider, for the the first time, it is thought, in this country, at the London Gliding Club at Dunstable.

In June the International Air Navigation Committee met at Lisbon and decided, amongst other things, that every aeroplane carrying over 2,000 kilograms must be fitted with wireless. As this decision, however, is not yet effective, the existing regulation holds good at the moment, viz., that every aircraft used in public international transport capable of carrying ten or more persons, including the crew, shall be fitted with wireless.

Equipment for aircraft continues to improve. The design for the two Scylla type aircraft of Imperial Airways, Ltd., may be taken as an up-to-date example of the Marconi company's equipment. The transmitter and receiver can be installed either in one unit or in two units according to the accommodation available. Quick wave-switching is provided for four waves between 500 and 1,000 metres. The transmitter, which uses two magnifier valves with a power to the anodes of 160 watts, can be used for telegraphy or telephony, with either fixed or trailing aerials. The weight of the combined transmitting and receiving equipment is about 100 lb., and provision is made for the installation of wing-coil apparatus for homing.



A standard 1.5-kilowatt Marconi installation for passenger ships.

The Marconi direction finder in use on a liner.

The commercial use of micro-waves appears at the moment to be confined to the Air Ministry's cross-channel circuit, already mentioned, and a circuit between the Vatican and Castel Gandolfo, but it seems likely that there is here a large field of utility awaiting development when it is remembered that between 20 and 40 cms. there should be room for a thousand times as many channels as between 200 and 400 metres. Much more, too, will soon be heard of circuits using waves of a few metres, but at present there are only a few in operation—the Post Office circuit between Cardiff and Weston-super-Mare, a circuit between Nice and Corsica, and half a dozen in the Hawaiian Islands.

Gas Discharge Condenser

RESISTANCES and inductances whose values could be electrically controlled have long been known. Mr. Murray Grimshaw Crosby has made a suggestion to complete the picture by providing a variable condenser, one plate of which consists of a glow discharge across a pair of electrodes. The discharge passes through a ring-shaped electrode which constitutes the other plate, and any variation in the intensity of the discharge gives rise to a variation in the capacity between the two plates. The intensity of the discharge can, of course, be controlled by varying the applied potential.

Diode Detectors

Conditions for Distortionless Operation

By J. B. LOVELL FOOT (*G.E.C. Research Laboratories*)

THE diode detector has become deservedly popular during recent years on account of its linearity. It is by no means distortionless, however, unless it is correctly used, and in this article the choice of optimum operating conditions is dealt with. It is shown that for freedom from distortion the AC and DC loads must be equal.

SINCE the article by H. L. Kirke appeared in this journal on April 20th, 1932, little has been published on the subject of distortion in diode detector circuits.

In that article Kirke showed how distortion arose when the detector received a deeply modulated carrier wave, and pointed out how it could be minimised by the choice of suitable values for the resistance constituting the diode load.

Although it does not yet appear to be generally realised, the diode detector circuit can, in the manner described later, give rise to very serious distortion on deeply modulated signals. The conditions for perfect rectification of a carrier wave modulated up to 100 per cent. are explained, and a practical method of obtaining this result is shown.

The Simple Diode Circuit

Let us first consider the case of a simple diode detector circuit as indicated in Fig. 1. Here an HF signal is received across the tuned circuit LC, to which the diode and the diode load resistance R1 are connected, with an HF by-pass condenser C1 shunting R1.

If the signal being received is unmodulated a steady DC potential develops across R1, due to the condenser C1 smoothing out the HF ripple on the rectified wave. The value of the potential is proportional to the signal strength, and if the diode were perfect (*i.e.*, having a zero impedance to current flowing in one direction and an infinite impedance to a reverse current) it would be almost equal to the peak voltage of the HF wave.

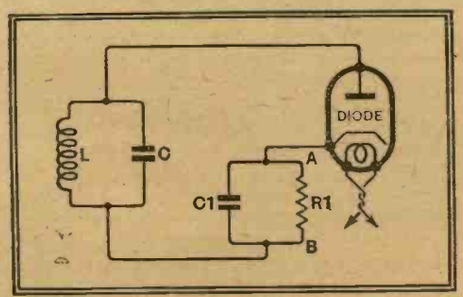


Fig. 1.—The fundamental diode detector circuit.

When the HF signal is modulated, this DC potential will rise and fall about its mean position, producing a superimposed LF wave similar to the fluctuations of the HF signal.

The current now present in the resistance R1 may be considered as consisting of a steady DC component due to the carrier wave, and an alternating current due to the modulation. It can be seen that the point A can never be negative with respect to the point B (due to the presence of the rectifier), but for a signal modulated to a depth of 100 per cent. the potential across R1 falls to zero at the instant the signal voltage reaches zero (neglecting small effects due to C1 and diode imperfections).

Fig. 2 shows a method of taking characteristic curves for a diode at different steady signal voltages. The resistance R1 is replaced by a battery E, which represents the steady DC potential developed across R1 (Fig. 1). The signal is obtained from a low-frequency source for convenience in measurements.

If we vary the battery voltage E, keeping the signal voltage constant, we can plot a curve of voltage and mean anode current giving the behaviour of the diode at that particular signal voltage, and Fig. 3 shows a series of these curves

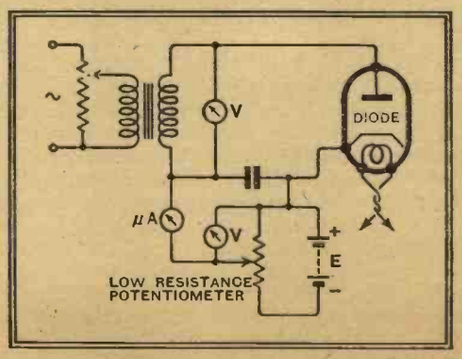


Fig. 2.—The circuit used for measuring the detector characteristics.

plotted for different signal voltages. The zero HF signal-voltage line is shown coinciding with the point O. This does not always happen in practice, for if a thermionic diode is used electrons may reach the anode from the cathode when the HF signal is zero.

On the curves shown a load line XO can now be drawn, the slope representing the resistance R1 (*e.g.*, if R=250,000 ohms, 2.5 volts would produce a current of 10 microamperes).

If the diode receives 4 volts of HF signal, this sets the steady working point at P. Now, when the carrier is modulated, a voltage swing will take place about this working point, and if the modulation depth reaches 100 per cent., the swing will be from P to the zero signal line and up to the 8-volt signal line.

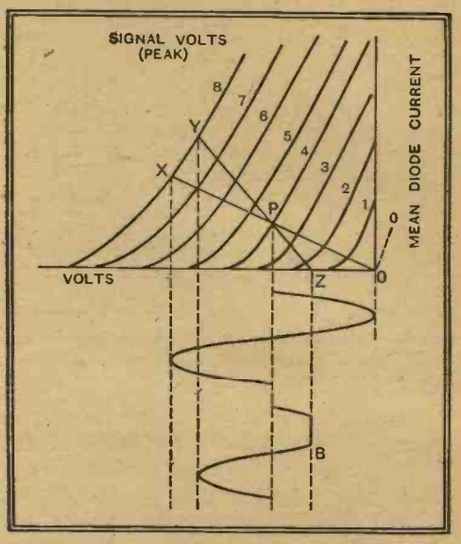


Fig. 3.—Typical diode curves are shown here with a DC load line XO and an AC load YZ of different values. The resulting distortion is shown at B.

It can be seen that during this cycle the current in R1 only just reaches zero on the downward peak, hence this simple diode can deal faithfully with a signal modulated up to 100 per cent.

Difficulties Due to Coupling

When the diode is coupled to an amplifier, it is usually necessary to prevent the DC component of the current from reaching the grid (except in cases of amplified AVC), as this would produce an unwanted bias voltage. In view of this a circuit such as in Fig. 4 is employed, where C2 is a blocking condenser and R2 the grid leak. It will be seen that this extra circuit in shunt with R1 provides a path for the LF current, but not for the DC; and, since it is inadvisable to make R2 greater than 1 megohm (and less than 0.5 megohm if R2 is made the volume control), the overall impedance of the load offered to the AC component is reduced considerably below the value of R1. If we now return to Fig. 3 we can draw in a steeper load line for the AC component YZ passing through the working point P. An inspection of this shows that for the 100 per cent. modulation condition, current in R1

Diode Detectors—

ceases to flow when the HF signal falls to 2 volts. Consequently, the wave-form becomes distorted, as shown in Fig. 3 (B). This effect can be demonstrated easily on a cathode ray oscillograph. Distortionless rectification can only take place with this arrangement on lower percentages of modulation, the critical value being

$$\frac{100\,R2}{R1+R2}$$ (for a perfect rectifier).

Improved Circuit

A satisfactory method of curing this trouble without biasing the diode is by modifying the diode load circuit so that the slopes of the AC and DC load lines are equal, i.e., the impedance of the load to the AC component equals the DC resistance.

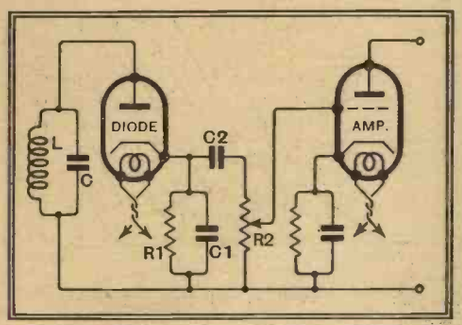


Fig. 4.—The usual coupling between a diode and an LF valve.

Suppose we insert an inductance L1 in series with R1, Fig. 5, the effect of this is to increase the impedance of the circuit to the AC component, leaving conditions for the DC component practically the same. Thus, by the choice of the correct inductance, we can arrive at a condition in which for a particular audio-frequency the desired result is obtained.

This can be carried a step farther, for it is well known that, in the circuit shown in Fig. 6, if we make $L1 = C2R^2$, we have a circuit in which the impedance between F and G remains constant at all frequencies, and is equal to the DC resistance R.

This can be utilised for the diode load by making R1 = R2 in Fig. 5. Bearing in mind the fact that C2 is the audio by-pass condenser which must not cause too great an attenuation at the lower frequencies, it is necessary that its capacity should be large.

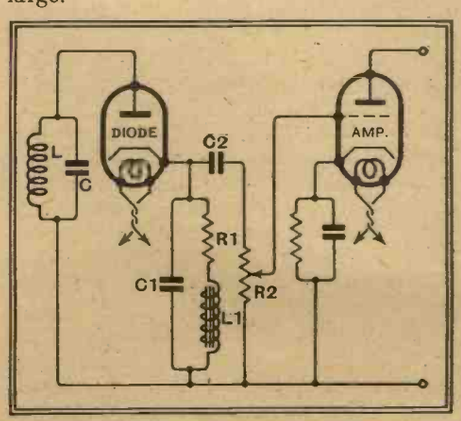


Fig. 5.—A modified coupling for distortionless detection. L1 has an inductance of 300 H.

If R1 and R2 are made 100,000 ohms, a suitable value for C2 would be about 0.03 μF. for an attenuation of 3.5 decibels at 50 cycles, and L1 300 henrys.

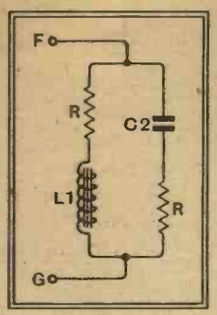


Fig. 6.—This circuit forms the diode load and if certain values are selected for components it acts as a pure resistance for all frequencies.

A design for an inductance on a very small "Laminic" core is given in Fig. 7. This has proved satisfactory for cases in which the peak voltage of the steady signal is below 25 volts, and the lowest modulation frequency required is above 50 cycles per second.

At lower frequencies than 50 cycles distortion, due to saturation of the core, may necessitate a larger stamping size.

The value of the HF by-pass condenser C1 depends on both carrier and LF signal frequencies; a suitable value would be about 0.0001 – 0.0002 μF. for normal use.

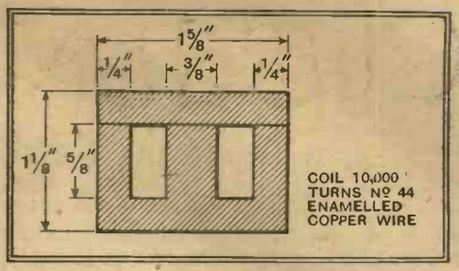


Fig. 7.—A suitable core for the 300 H. choke can be built from 25 pairs of varnished Laminic stampings, 0.015 in. thick.

An important point liable to be overlooked is that of the damping on the HF input circuit. For the arrangement in Fig. 4 the damping increases with the HF signal voltage, and tends to modify the modulation of the signal which is being detected; this is because the mean carrier is damped less than the sidebands, and is due to the difference between the AC and DC load lines for the diode, as described previously.

All the effects given have been checked on a cathode-ray oscillograph with signals obtained from a deeply modulated oscillator.

Short-wave Broadcasting

THE B.B.C. has recently announced the commencement of some important tests which should result in improved reception of the Empire Station in Australia, New Zealand and India. For some weeks past, changes in the aerial system used by GSD and GSE have been made every fifteen minutes, and five aerials are now undergoing comparative tests.

Listeners in South Africa have already noticed an improvement in reception, thanks largely to the new aerials that have been provided for Transmission IV. These comparative tests present the most extraordinary difficulties, for, as is well known, propagation conditions on short waves are capable of undergoing a complete change in a few minutes.

Reports indicating a change in signal-strength, therefore, cannot be assumed to have any particular bearing on a change in the aerial system, unless the two aerials under comparison are used alternately over quite a long period.

Amateur transmitters are well acquainted with the false results that a sudden change in conditions can produce, and although the variations undergone by a high-powered broadcast transmission are not nearly so serious, they are quite considerable.

One or two readers have commented recently on the prevalence of "night-distortion" on short-wave broadcast. Sometimes this is in the form of high-speed fading, which can render a programme very nearly unintelligible, and sometimes it is more of an "echo" effect. A.V.C. does nothing whatever to compensate for real high-speed fading, which sometimes takes place at a frequency as high as 25 cycles, and one is more or less helpless.

Sometimes, if it is possible to erect two aerials a score of yards or so apart, and to feed them into the set by means of two separate windings coupled to the first tuned circuit, one *can* do away with the trouble. It takes place, however, only when conditions are in a certain phase, and then usually only on one or two stations, so that it is hardly worth while to arrange any elaborate precautions.

As usual, most of the new stations reported "on the air" hail from Central and South America. One reader reports a round dozen Colombians, together with new stations in Cuba, Dominican Republic and Ecuador. The Brazilian stations do not seem to make themselves heard very often, the zone of good conditions centring round the Equator.

The year 1934 has been an extraordinary one chiefly for this particular property. Never before have we heard so many stations from that part of the world. It may be simply that the stations are increasing in power and in numbers, and that they will be always with us from now onwards.

There is a persistent rumour of a group of high-power short-wave broadcast stations in India. Whether there is anything in it remains to be seen, but we already receive Bombay and Calcutta quite well. The stations that are conspicuous by their absence are the old favourites in Indo-China and Siam, who used to come across every afternoon at remarkable strength.

HS1PJ was quite a notoriety in its time, but the other stations that are listed as "Saigon" are hardly ever heard.

The new Australian, VK3LR, seems to be fairly consistent. How many readers realise that they need no longer depend upon VK2ME's Sunday morning transmissions for Australian reception? VK3LR transmits every morning except Sundays, on the 31-metre band, and is usually received at excellent strength until 8 a.m. or thereabouts.

Another interesting station recently heard was ZLW, Wellington, New Zealand, on about 29 metres. This, however, is not a regular broadcaster. MEGACYCLE.

CURRENT TOPICS

Events of the Week in Brief Review

Nearly Six Million

GERMANY'S new licence total of 5,911,330 means that 9 per cent. of the population are now registered listeners. The percentage in Great Britain is approximately 13.

Five-metre Tests by I.F.S. Army

UNDER the auspices of the Army authorities the first series of tests on 56 megacycles in the Free State have been carried out at Baldonnell Army Aerodrome, Co. Dublin. The tests were directed by Mr. J. B. Campbell (EJ5B), one of the best-known wireless transmitters in Ireland.

Radio Ghost Train

"HAVE you heard the wireless 'ghost train'?" asks the *Irish News* of Belfast. It seems that many radio enthusiasts in Northern Ireland have been troubled by a peculiar clanking sound which refuses to be tuned out and is heard on all wavelengths. The sound "is peculiarly like a train panting up a gradient with a heavy load." Our contemporary states that thousands of theories have been put forward to explain it, many of them fantastic but none of them satisfactory.

Have you heard it yet?

Physical Society's Exhibition

WIRELESS is always well represented at the Physical Society's exhibition. The twenty-fifth of the series is to be held on January 1st, 2nd, and 3rd at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London, S.W.7. Admission is by ticket only on Tuesday and Wednesday, but the public is admitted without ticket on Thursday from 3 to 6 p.m. and from 7 to 10 p.m. Tickets may be obtained direct from the Exhibition Secretary, 1, Lowther Gardens, Exhibition Road, S.W.7.

Private Radio Sets in Ships

MASTERS of British ships have met with difficulty owing to the fact that particulars of wireless sets (other than those installed for the ship's use) which are owned by the master or members of the crew and carried in the ship are not entered in the ship's manifest. The Customs regulations in certain countries, including France, require particulars of such sets to be entered in the manifest of ships' stores.

Esthonia Starts

ESTHONIAN broadcasting is to pass from private hands into State control. A new 40-kilowatt station is now in course of construction.

Have You Got Your Fünf-Pol-Regel-Röhre?

TECHNICAL bodies in Germany have succeeded in creating new German designations for valves. The aim has been to substitute for terms derived from the Latin or Greek, such as pentode, octode, etc., names of good German derivation.

A variable-mu high-frequency pentode will in future be called "Fünf-Pol-Regel-Röhre," and the duo-diode becomes a "Doppel-Zwei-Pol-Röhre." A pentode is, of course, a "Fünf-Pol-Röhre."

Laughter at 5.35 a.m.

GERMAN comedians are to brighten life for early risers who tune in the Deutschlandsender broadcasts between 5.35 and 7 a.m. daily. These artists have been instructed to liven up the spirits of German listeners and make them more fit for the day's work.

It is not stated who will liven up the comedians.

Three Days

READERS who have not yet purchased, or been presented with, a *Wireless World* Diary for 1935 still have three days in which to secure a copy and start their daily entries on January 1st. The Diary is, of course, more than a diary; it is a pocket-book of invaluable information to all who touch wireless in their daily life, whether as broadcasters, listeners, technicians, manufacturers, or amateur transmitters. There are seventy-nine pages of facts, formulæ, and general information, including valve data, circuit diagrams, hints and tips, and coil-winding particulars.

Bound in leather cloth with back loop and pencil, the Diary costs 1s. 6d. at all booksellers' and stationers', or can be obtained direct from our Publishers, price 1s. 7d., post free.

EVERY SATURDAY EVENING from 10.30 to 11.15 the League of Nations transmitters (HPB, 38.48 metres and HBL, 31.27 metres) at Prangins, Switzerland, broadcast a talk by the League Secretariat in English, French and Spanish. The picture shows the control engineer at the switchboard linking the various offices to the amplifier channels.

The Wireless League

AT the Annual General Meeting of the Wireless League on December 12th the Hon. Sir Arthur Stanley, G.B.E., C.B., M.V.O., was re-elected Chairman.

Ultra-short-wave Broadcasting

A DAILY relay of the Deutschlandsender programme on ultra-short waves begins on January 1st. The object is to permit reception tests over longer periods than hitherto, and each relay will begin at 4 p.m. and continue until midnight. The service will be interrupted for an hour each evening for television transmission.

50 Kilowatts from Latvia

A NEW Latvian transmitter at Goldingen is now testing with an aerial output of 20 kilowatts on a wavelength of 238.5 metres. We understand that the power will be increased to 50 kilowatts in the spring.

A Happy Surprise

FRENCH listeners are overjoyed with a budget which has been voted at record speed providing a supplementary credit of five million francs for broadcast programmes. Our Paris correspondent states that this welcome radio "manna" will be judiciously divided between the State stations.

New Austrian Stations

SEVERAL new Austrian transmitters will be operating in the near future. The old Rosenhugel station at Vienna, now used as a reserve for Bisamberg, will be transferred to Linz, while the relay station there will be removed to the North-west Tyrol. When the new transmitter has been constructed at Innsbruck, Austria will have eight stations operating.

Hallowdame Calling

VARIOUS European countries have had difficulty in choosing a name for the announcer. France invariably refers to the "speaker" or "speakerine," and has even perpetrated "annoncatrice." Now in Norway the announcer answers to the name of "Halloman," and Iceland Radio (Reykjavik) has given its lady announcer the official title of "Hallodame."

Supertax on French Listeners

WHAT French listeners have dreaded for some weeks has become a reality, writes our Paris correspondent. Radio receivers are to be supertaxed for the benefit of the theatre industry, and the news, though not unexpected, has aroused antagonism.

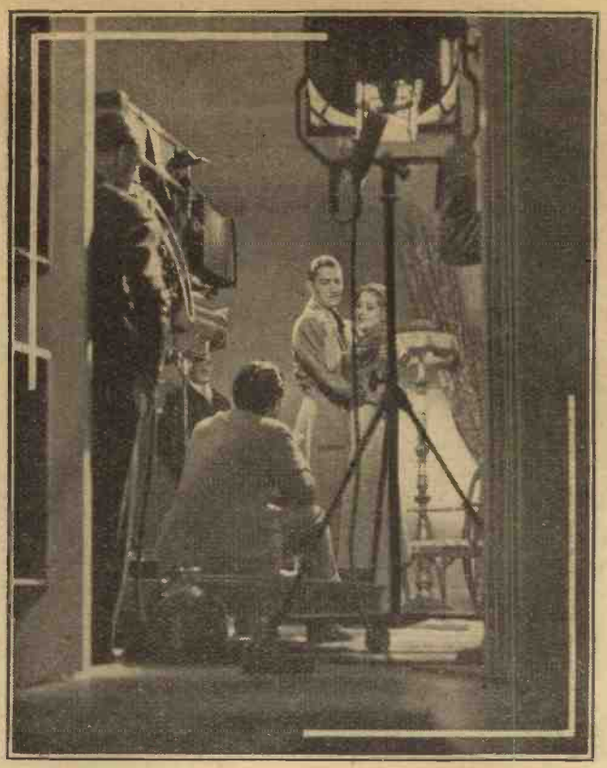
It has always been difficult to persuade French listeners to consent to any wireless tax after having enjoyed radio gratis for ten years. Only the undertaking that the proceeds from the tax would be devoted to station and programme development secured their reluctant consent.

Television and the Cinema

Are the Two Arts Compatible?

By DALLAS BOWER

IN the opinion of the author television and cinema art, far from being antagonistic, are complementary to each other. This vigorous article puts forward the view that television programmes of the future will depend upon film records for the artistic completeness which would be lacking in direct or "real life" television.



What the picture-goer does not see: Producer, cameraman and sound engineer all seek perfect conditions before the "shot" is taken.

RECENT information regarding television and the cinema has caused widespread interest amongst cinema exhibitors throughout the country, because every exhibitor knows that television is liable some day to queer his pitch. At the last Annual Conference of the Cinematograph Exhibitors' Association a reassuring paper on television was read in which members were told that the modern sound-cinema had nothing to fear, as television was yet too imperfect technically to threaten competition on any solid basis. Whilst in the main this assertion is undoubtedly correct, the fact remains that television is as much advanced now as sound was when it entered the cinema in 1928.

There were a great many sceptics at that time who insisted on regarding sound as a nine-days'-wonder. It had come into the vast industry of film production and exhibition so suddenly that it was not taken seriously, and this attitude prevailed for some time after it had become blatantly obvious that sound had made its mark and had come to stay.

Logically, therefore, it is neither alarmist nor premature to say that *now* is the time for the cinema to consider television so as to meet it with properly organised plans for serving the interests of the nation in general and the filmgoing public in particular. It is easy to say that television has at present no artistic integrity and cannot as a result be considered desirable as an entertainment form. This is a truism, but it is no more so than it was of the sound-film seven years ago. Sound in the cinema has developed enormously since its inception, so much, in fact, that the film has been able to regain its artistic quintessence, and now Distinguished Critics delight in telling us the sound-film is the Art of the Future.

Even outdoor scenes in the cinema world to-day are often compounded of pasteboard and carpentry. The photograph shows a busy scene in a dummy courtyard when the London Film Production "Catherine the Great" was in the making.

What is "Television"?

Apart from the purely technical aspect of monochrome, very few opinions have been expressed on the "form" of television. Let us, therefore, define the word. Generally stated, it means "seeing at a distance"; that is to say, television implies a system which enables us to see events occurring simultaneously to our instant of being, but at a place outside the range of natural vision. The word itself in no way qualifies the form in which events are presented.

It must be appreciated that the reproduction, *sine qua non*, is two-dimensional only as a result of our being accustomed to accept a two-dimensional representation of an image-event as possessing sufficient verisimilitude to convince us of its apparent reality. The Dutch painters of the greatest school achieved such virtuosity in creating the *impression* of depth

Television and the Cinema—

that their representations of interiors are ultra-photographic, though we know that their canvases are as flat as pancakes. In the same way, a scene on a cinema-screen is life-like enough to convince us by representing things which are to all intents and purposes *sufficiently near the shape* of the things as they are in actuality. The word "television," however, does not limit itself only to two-dimensional picture-representation of image-events, but applies equally well to three-dimensional spatial re-creation of actuality. In short, the "perfect" television system is identical with the "perfect" cinematograph system from the point of view of verisimilitude. The form of reproduction will be sculptural and not stereoscopic, because stereoscopic reproduction is no more than a slight strengthening of illusion; the viewpoint is still essentially two-dimensional, just as in the animated theatre the scene is "bound" by the proscenium frame. You cannot either in the cinema-hall or the theatre "look round the corner." Presumably on the assumption that prophecy is futile, very few film theorists have speculated on the "perfect" film.

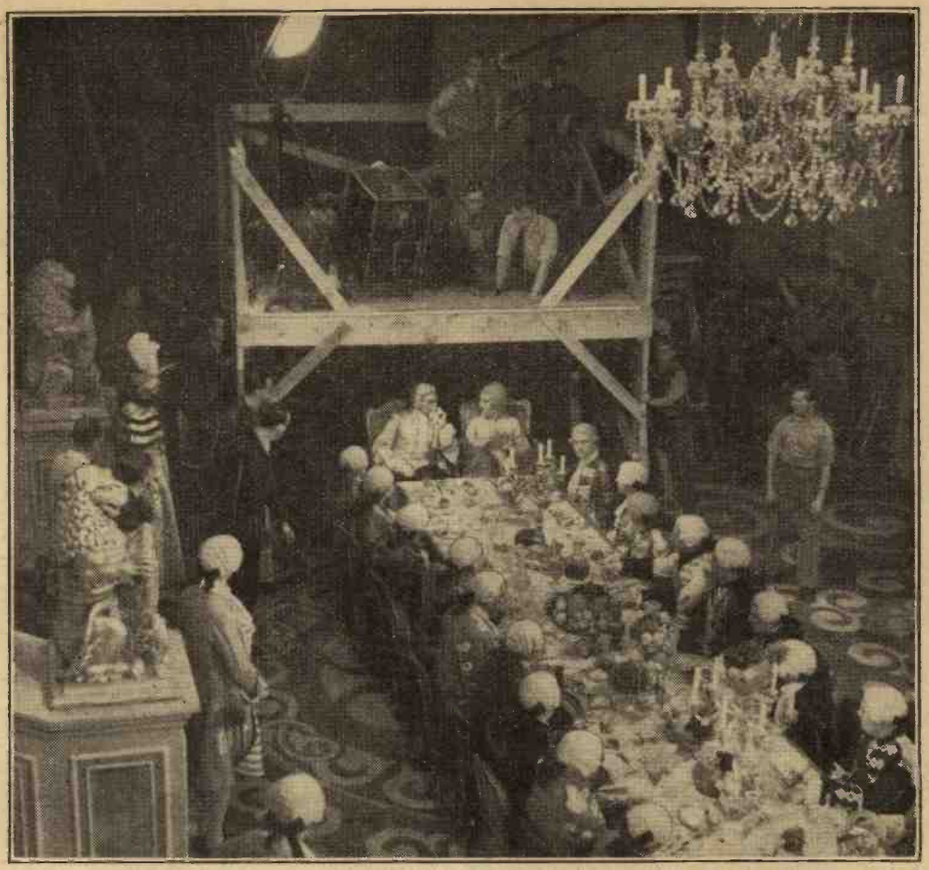
Three-dimensional Effects

No one, with the exception of Mr. Norman Bel-Geddes, has tried to foresee what sort of building the cinema-hall of the future might be. All manner of elaborate theories have been advanced on the ideal screen shape and so on, but they are in no way fundamental, as the premises on which the theories are based assume in every case the two-dimensional film of to-day. So far as one knows, the possibilities of projection on to an opaque sphere or cylinder have not been considered, and it seems that the "perfect" film might lie in this direction. It must be understood, however, that such a film would only be perfect in the ideal technical sense, inasmuch as it would re-create actuality of one or more specific events. Whether or not a series of such events could be given coherence by the editing process, which is the æsthetical foundation of two-dimensional film construction, is a matter no one can foretell until the perfect film has been achieved. In all probability the visual effect of a "cut" would be so powerful, due to the *presence* of depth and not merely the illusion of it, that each change of scene would take the form of a violent visual shock. Consequently, we cannot discuss the æsthetical aspects of such a film, nor have we need to at this juncture, but it has been necessary to make the hypothesis, and for this reason:—

For purposes of entertainment television must be synonymous with film television.

The type of television the B.B.C. at present provides is usually called direct transmission, to distinguish it from the transmission of films. It is a scientific novelty which doubtless has great possibilities for commercial purposes, but as entertainment it is strictly limited, and in its present form always will be strictly limited.

The first talking films, due to camera and microphone immobility, were really no more than moving photographs of stage plays proper in which the characters stood still and talked. They were interesting purely as a novelty, but as entertainment they lacked the essential quality of both the cinema and the stage. They were neither one thing nor the other. The sound-camera could make a record of a play's dialogue and the visual-cinema record the action. It seemed at first to be only a documentary device, giving a useful but dull and rather poor replica of the stage, with nothing of the unique qualities of the silent screen—movement, physical freedom for locale, unrestricted tempo of action. As entertainment precisely the same applies to television in its present condition.



"Actuality, stark and bare, is usually dreary." The contrast between actuality and make-belief is well illustrated in this picture—also taken during the production of "Catherine the Great."

Drawbacks of Stark Actuality

The public has become accustomed to first-class films, with all the technical virtuosity the modern screen offers, and good stage plays with actors of flesh and blood. It will accept both readily, with a marked preference for the cinema due to reasons which are not technical or artistic, but sociological, and consequently need not concern us at the moment. But direct television can never do more than reproduce actuality, even if it is "perfect" in the sense of the "perfect" film. And actuality, stark and bare, is usually dreary, often horrible, and always dull. Any entertainment, no matter of what kind, must be to an extent a dramatisation of actuality; if this is presented by a means which possesses neither the sweet union of living contact between actor and audience that obtains in the theatre nor the special qualities of screen or broadcasting, but merely offers a faint similarity to all three with none of their most valuable attributes, we have here, surely, something with which entertainment as it is generally understood has no concern.

This, of course, is not to say that direct transmission has no value whatever. Obviously, judging by the devastating seriousness with which Test Matches are taken, a direct transmission of one would mean millions of eyes riveted to the home televisor screen in ecstatic abandon. Items of news and topical events transmitted direct to the home in the form of a "news service" unquestionably would be more attractive than a broadcast running commentary is to-day.

Also, such programme items as variety performances would certainly gain in entertainment value by the addition of vision, particularly in the case of comedians whose faces are usually their fortune. Beyond this kind of material, however, it is difficult to see where lies the future of home television operating from a direct transmission service.

And there is another aspect of home television reception in its relation to broadcasting which so far as one knows has not yet been considered. Television reception

cannot be casual. Most broadcast listening is emphatically so. The fact may be deplorable, but the popularity of broadcasting as an entertainment is no doubt largely due to one being able to listen to a programme whilst engaged upon some other activity at the same time. Exceedingly few people listen with concentration. It is possible with sound only because the orientation is universal; but with vision as well as sound one must stand or sit and look at one particular place. It is an entirely new condition of home leisure—and a very awkward and inconvenient one too. For proper appreciation a special room is needed. In short, television in the home becomes tantamount to "going out" to the cinema or the theatre, but shed of its rather subtle psychological pleasure. The majority of people "go out" because they like to leave the environment of their homes and worries for a few hours, although few will admit this to be a valid reason because they are quite genuinely unconscious of it. Besides, man is a gregarious animal and is happiest when he is taking his leisure in the mass. It is therefore permissible to speculate that the most desirable form of direct transmission service to the home would be as an adjunct to the telephone system and not to radio broadcasting, because by this means not only could a news service be provided, but duplex receivers and transmitters could also be of great personal utility.

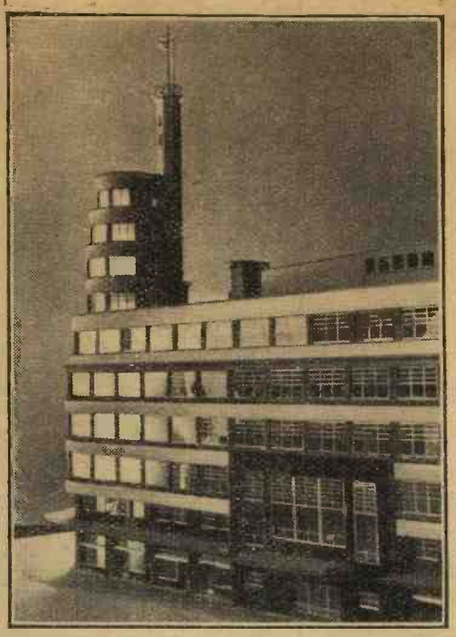
Despite its possible disadvantages, personal television is undoubtedly the most important branch of direct transmission, and a wire, as distinct from a wireless, system of distribution seems to be the line on which the problem should be tackled. If, on the other hand, television progresses in the way it is going at present, then presumably the B.B.C. will organise the service, ultimately taking responsibility for it as a department of broadcast entertainment. How this could be done without the use of film is difficult to see, as quite evidently a mere visual transmission of broadcasting performances cannot be regarded as anything more than an amusing scientific game, a fact the foregoing proves to be abundantly clear. Film seems to be an essential requisite before a service can be established.

National or Private Enterprise

If the Television Committee decide to grant the B.B.C. monopolistic power, presumably it will be in relation to the transmission and reception of television for home purposes. Supposing a home-televisor capable of giving as good a picture as an up-to-date small-screen home cinema (some systems claim to do so), what effect, if any, is this going to have on cinema-going?

Even with a picture of high definition it is doubtful whether *as an entertainment* such a service could compare with the modern cinema.

In the first place it would mean the B.B.C. becoming film producers, or at least empowered to tender for the production of films on its behalf.



BROADCASTING HOUSE, BRUSSELS. Part of a model of the new headquarters of Belgian broadcasting, to be completed next year.

A good entertainment film costs in this country anything between £15,000 and £80,000 to make, a fair average being about £25,000. Where is such a sum, supposing the requirements amount to a new film each week (which they would), to be found? The figure, £1,300,000 per annum, is reckoned as a minimum for the production of the films only, irrespective of all other costs necessary to provide an efficient service. It could, of course, easily be raised by television reception licences, but the vital question is: *Would the public pay an extra licence and purchase a fairly expensive instrument in order to see films in the home which, could they be seen in a big, modern cinema, would be technically better and viewable in greater comfort?*

The answer seems in the affirmative, providing the licence fee is not excessive and televisors can be bought inexpensively, the latter, of course, being inevitable on the establishment of any sort of real service. Such a scheme with the B.B.C. as intermediary would mean subsidisation for the British film industry without any of the rigid control usually associated with Government-financed activities; it is possible it might also be the thin edge of the wedge in repealing the much-abused Quota Act. British production companies would be assured of a certain output of films each year as contractors to the B.B.C., while also being free to produce as they wish in the ordinary way. The exhibitor would not suffer by what he might think to be direct State competition with his livelihood because the entertainment he has to offer would be *of a different quality* in the way that listening to broadcast variety is different from going to a music-hall itself.

The exhibitor might argue that eventually, so near may home television become to normal cinema conditions, and in consequence so vast the revenue for expenditure on elaborate productions, the cinema hall would be in danger of extermination. That may be possible, but by that time the cinema of the future will have arrived with three-dimensional actuality. And besides, people will still want "to go out."

Amplifying Direct Current

IT is well known that audio frequency amplifiers, as ordinarily constructed, have a lower frequency limit of operation. The coupling between one valve and the next is effected either by means of a transformer or a condenser, and in neither case is the output responsive to a change in the steady state of the input.

Taking the case of a condenser coupling, we say colloquially that the condenser "will not pass DC." If, therefore, fluctuations of potential corresponding to any repeating waveform are impressed on its input terminals, the average potential on the output terminal will remain constant after sufficient time has elapsed for a steady state to be established.

This limitation is of no consequence in the case of amplifiers used for acoustic purposes, but is important in the case of television or picture transmission systems. If no steps are taken to counteract the effects above mentioned, a television picture will have the same average light value in all cases; if the subject being transmitted is either totally black or totally white, the illumination on the receiving screen will be the same, and false values will thus obviously be given to transmitted pictures in general.

To overcome this difficulty without the necessity for designing a DC amplifier, Mr. Frank Gray has suggested taking advantage of the fact that in a television picture "black" is generally transmitted at the end of every strip, and that, in consequence, if the received signal potentials, without unidirectional component, are applied via a condenser to a rectifier connected in the appropriate sense, current will only flow through the rectifier at the moments corresponding to "black," and will charge the condenser in such a manner that the potential of the terminal connected to the rectifier is constant at these moments.

"Black" is thus represented by a constant potential and, since the potentials corresponding to other gradations are in correct relationship to "black," the output across the rectifier will have the unidirectional component correctly put back. The effect is thus as if "direct current" amplifiers were used throughout the transmitting and receiving systems.

It is obvious that a scheme of this sort can only be applied in cases where a repetitive wave form is transmitted which has maximum or minimum corresponding to a given value of direct current component. As this is practically universal in television and picture transmitting systems, Mr. Gray's method of operation appears highly suitable in these cases

Short Waves and the Amateur

The Value of Experimental Transmissions

By G2TD and G5KU

IN the early pioneer days of radio communication, the experimenting amateur was allowed fairly considerable latitude, both with regard to wavelengths employed and types of transmission used. Increasing commercial traffic on the 1,000-metre band, at first allocated, drove him to the 440-metre spectrum for the remainder of the days when the voice of broadcasting was unknown. The call signs 2OM, 2ON 3NM, 2KT, 5BV, etc., which were then not prefixed by their country's symbol G, are remembered for their Sunday morning activities, frantic night calls to the only amateur then active in Scotland, and many pleasant hours spent listening to C.W. speech and music with a single-valve receiver of truly staggering proportions. The advent of broadcasting as a national form of entertainment automatically eliminated the amateur from the 440-metre band and he was relegated to 200 metres, which was then considered to be of little commercial value for long-distance transmission. The transatlantic tests of 1921 organised through *The Wireless World* soon dispelled this fallacy, but it was not until considerable research into the properties of the Heaviside layer was made that the mechanism accounting for these long-distance transmissions could be fully understood.

Beyond this year the story is one of rapid commercial progress. The great commercial companies began to take a very serious interest in short-wave developments, although it is not an implication that experimental work had not occurred at very much earlier periods. It nevertheless follows that the speeding up of short-wave development for long-distance communication was due to the success of amateur effort, by which the world had been spanned with less than a ¼ kilowatt of power input to humbly constructed transmitting apparatus. The amateur has since been granted liberal concessions and is now allowed to operate over very useful portions of the short-wave spectrum.

Accidental Discoveries

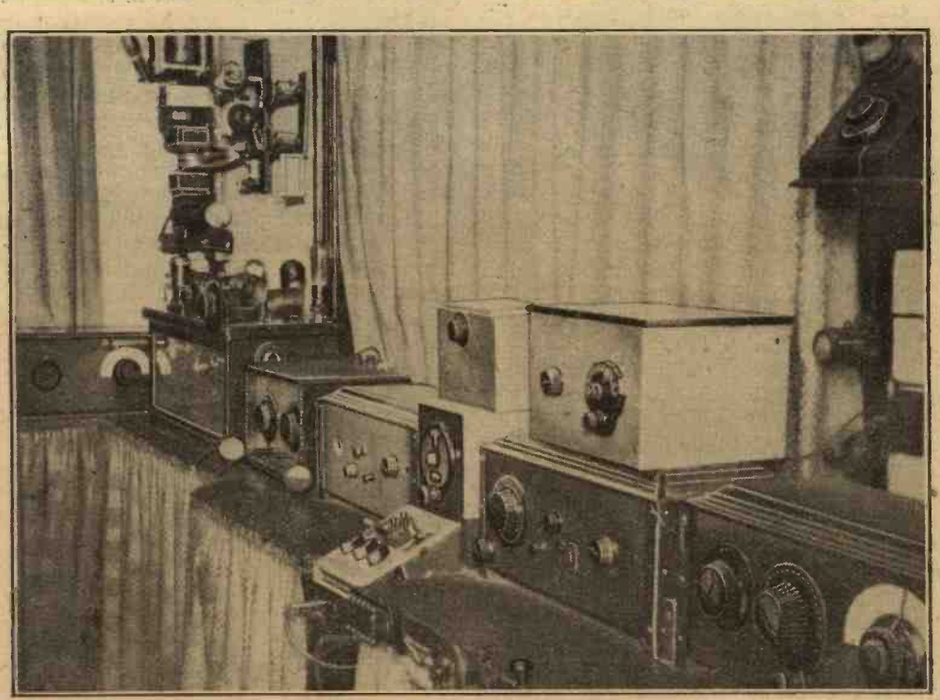
How then can he achieve anything of real value? It must be remembered that great resources of finance and technique lie behind the daily work of engineers and physicists who are advancing the art of short-wave communication, and the properties of transmitters, receivers and aerials have been so fully exploited that little remains for the amateur in this connection. An enthusiastic amateur may spend many weeks of trial and error work in accounting for some phenomena which a skilled engineer could elucidate in a few seconds.

Yet, amongst a band of "hay wire," key-thumping hams, living in technical oblivion, there may exist a precious handful of amateurs who will make some valuable contribution to the science as we know it at present. The possibility of further accidental discoveries of a revolutionary nature is very remote. Just as electromagnetic waves were mathematically discovered by Maxwell before they were produced by Hertz, so the behaviour of these waves or aerials and of circuits may be very accurately predicted long before a practical test arises.

Typical of amateur stations of 1922, which worked on a wavelength of 180 metres.

Useful Research

To those seriously interested in investigational work it is very disappointing to call a station and obtain a hasty reply, thanking one for the call and asking for a pretty card to pin on the wall. Any suggestion to the effect that a series of experiments is to be conducted is met with a curt "QRU" (nothing further for you) and he continues his mad errand of QSL card hunting without the slightest intention of carrying out any useful work. Fortunately the British amateur is less prone to this offensive habit than most countries, since the licence regulations are stricter and a close official watch is maintained on amateur wavelengths. An examination of the Post Office questionaire and application form for experiments in wireless telegraphy, etc., indicates the stringency of the conditions governing the issue of the necessary authority for transmission; and yet a careful exploration of the amateur bands reveals that very little work of an investigational nature is being carried out. How many licensed transmitting amateurs in this country are equipped with a simple comparative field strength measuring apparatus? Without this indispensable tool, results are almost meaningless. The "R"



A modern short-wave amateur transmitting station, G2DQ, owned and operated by Mr. H. G. Collin, Wickford, Essex.

Short Waves and the Amateur—

code is the roughest experimental guide and of no use in determining absolute relative values or distinguishing changes of less than 25 per cent. The determination of "R" code strength varies with listeners to a great degree and final deductions may be as much as 200 per cent. in error.

One suggestion for the conscientious amateur is a study of high-angle transmission during the periods of darkness when a waveband, such as 20 metres or less, is usually accepted to be dead. It is possible that results may show a fair degree of usefulness under new methods. Fading of signals between stations less than 20 miles apart occurs during nightfall, not entirely attributable to scattering effects, and the writers have been taking figures by field strength measurements in order fully to investigate the effects. A probable theory is that part of the received energy is not due to the ground wave (which is theoretically the only possible path at short distance) but to energy reflected from components of high-angle radiation. This is something relatively new and interesting to study, falling as it does into the category of useful experimental work.

DX Notes

After considerable attempts at communication to South American districts at late night on 20 metres, it is found that effects are, on the whole, very unreliable; although much interesting work is there to be followed through the winter. It is considered that more reliability is to be found soon after sunrise in this direction and a consideration of the sun's retreating shadow band shows a line of sunrise sweeping down from Northern Europe to South America, leaving the North American continent in darkness. It is just possible that the high level on JNJ, etc., at this early hour is due to signals following the "via Panama" route from Japan to England.

All You Need Know in Radio

By "CATHODE RAY"

Clearing up the Mysteries of Higher Technicalities

THIS festive season, sometimes jocularly termed Holiday, is so full of things that there is grave danger of the necessities of life being crowded out by the luxuries. This page, for example, might receive less attention than usual, by reason of the prolonged concentration ordinarily demanded by it. As a concession to the flesh, therefore, I am this week bestowing a complete treatise on radio. It is so light that it can be assimilated even after the pudding, and yet so comprehensive that it is a good defence against the loss of dignity that is entailed by party games of the general knowledge sort.

Experience has shown that the whole of anything is equal to the sum of its parts. Know each part, and you know the whole. Samson himself might have struggled in vain to snap a bundle of firewood. But a child can take a stick at a time and break it. The reason why radio is found to be so difficult is that the student takes the whole bundle in his hand and expects to build Rome in a day. But when the loaf has been daintily sliced into separate grains of sand it soon makes a mighty ocean; to put it metaphorically.

Each mysterious part of radio will now be clearly defined. This knowledge has hitherto been confined to a few experts; now it is all revealed in language that everybody can understand.

Band-pass. You don't suppose the musicians pay to get in, do you?

Condenser. High Official of the B.B.C., the duty of whose staff is to fit the programmes in. His work is often in vain, and may be either fixed or moving. Bach programmes are usually arranged by a **Padding Condenser.**

Earth. All natural wireless sets must be planted with the roots firmly underground, and well watered. A flower pot is not recommended; it might be neglected during holidays. Chemical manure is sometimes used, in small copper pots. Portable sets are grown under a frame and need no earth.

Eliminator. Chemical preparation for combating parasitic oscillation.

Feed-back. A concomitant of **Instability** (q.v.); also noticed just after Christmas, and at other irregular seasons.

Gang-control. The official duties of Dr. Adrian Boult.

Hand Capacity. A high-frequency phenomenon particularly noticeable on leaving a hotel, whether equipped with wireless or not. It is believed that some form of direction-finder is used by the staff, for screening seldom avails to prevent one from being run to earth.

Heaviside Layer. That portion of the B.B.C. programmes lying between afternoon and evening.

High Tension. A state which is liable to exist as a result of **Pre-selection.** (q.v.)

Image Interference. The encroachment of television signals.

Instability. See **Night Effect.**

Lightning Arrester. Post Office official equipped with clever apparatus that responds to absence of licence.

Microphonic Noises. Technical term for broadcast programmes.

Mutual Conductance, High-frequency Coupling, etc. These expressions are too romantic in tendency to be discussed in a prose journal. The subject is more suitable for anode.

Night Effect. The sensation of seeing two or more programmes at once. Sometimes known as **Instability.**

Ohms Law. The law relating to Income Tax (or Automatic Gain Control).

Output Stage. Generally coincides in time with **Night Effect**; usually 10 or 10.30 p.m. **Noise Suppression** may also be necessary at this stage.

Padding Condenser. See **Condenser.**

Phase-change. Often observed when a visit is paid by a **Lightning Arrester.**

Pre-selector. Scientific term for acquisitive junior member of a family. The pre-selector stage is reached at the age of about two years.

Reaction. A common result of **Night Effect.** A Pick-up may be needed.

Relay System. This is a trade secret jealously guarded by the dairies.

Speech-choke. Would be very valuable, but is not permitted in this country, as it conflicts with the tradition of "freedom of speech."

Super-het. A very powerful type of receiver that brings in every station, and most of them twice. From the American super—very, and het—hot.

Threshold Howl. A form of interference peculiar to Christmas. Is closely associated with **Hand Capacity.**

Tweeter. Pet name for Leslie Sarony.

Ultra-violet Ray. The most malignant and irremediable form of interference. In accordance with the doctrine that the best form of defence is attack, it is widely employed as an Interference Suppressor.

Variable-mu. Another, and entirely different, variety of **Night Effect.**

Watt. Electrical Unit of energy; named after well-known B.B.C. producer.

Wavechange Switch. Despite the popularity of so-called continuous or permanent waves, this appliance meets with some application in the art of coiffure. Closely associated with step-up transformation.

Wired Wireless. Usually called just "Wireless." The reason for this is unknown.

And if there is anything more to know, you can depend upon it that it is not worth knowing!

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

High-Note Reproduction

DR. R. T. BEATTY, in his article "Those High Notes," suggested that there are two serious obstacles to hinder perfect reception.

I should like to draw attention to another obstacle quite as serious. I refer to the listeners themselves. I am not going to be so foolish as to assert, as some people do, that the average listener does not appreciate good high-note reception, but I maintain that the average listener must be taught how to use a set capable of high-note reproduction.

The majority of listeners have become so accustomed to listening to sets deficient in high-note response that when they get a set capable of reproducing high notes they turn down the tone control to maximum cut off and say, "I prefer it mellow."

During the last few months I have fitted quite a good number of a well-known make of console receiver with a very high standard of reception.

Whenever I have had this preference for "mellowness" I invariably find that the user listens at a volume much greater than is required for the room used. Adjusting the volume and turning the control up to minimum cut off never fails to convince the listener of the naturalness of good high-note reception.

WM. SMURDEN, A.I.W.T.

King's Lynn.

Alternatives to Home Television

I AM glad to see from your issue of November 16th that my article on the above subject in *Wireless World* of October 12th has stimulated other readers to interest themselves in the subject. I had, of course, hoped that it might.

In reply to Mr. C. H. Evans, I am not aware of any firm which is specifically developing or exploiting the system of "retarded television." So far as I know, the method merely exists as a suggestion which is open to anyone to explore or exploit. I would, however, refer him to something that has occurred since the article was written. This was the arrival of Scott and Black in Australia in the big air race. Their arrival was filmed in the ordinary way, and a short length of this film was transmitted, frame by frame, by facsimile wireless. At this end these were reproduced in the ordinary facsimile manner, and the resulting series of still pictures photographed frame by frame into a short film which was exhibited in the ordinary cinema theatre news reels. I think it was done by Gaumont British. The particular technique used was indirect and clumsy compared with what could be done by a more definitely organised service, while the transmission channel was undoubtedly a difficult one, which kept down speed of operation. The result, which I saw quite casually in the course of a cinema visit, was consequently not very good, but showed, nevertheless, what promise the method offered.

With reference to Mr. D'Orsay Bell's letter I fear that in the light of his exposition, and in the absence of even a bare indication of how, technically, it might be carried into effect, his suggestion must meantime rank as no more than a somewhat philosophical abstraction.

Against such a view the intention of my original article was to deal with things that are now within existing known technique—a severe restriction from which the technical writer frequently suffers in comparison with his more fanciful brother of fiction.

Mr. D'Orsay Bell envisages a translucent screen which "begins to glow, and in another second is fully lit up with the scene, in all its natural colours, at which the audio item has arrived. The picture is 'held' for a moment or two and then fades away, but in another twenty seconds or so the glow again appears and develops into the next picture." I will instantly agree that if one knew how this was to be accomplished it would be an infinitely more pleasing alternative than either of those with which I dealt (under the restriction already postulated). But Mr. D'Orsay Bell later adds naïvely that "there are, of course, a lot of points that require working out." I fear he is right; indeed, I fear that the whole thing wants working out, particularly the building-up and retention of the picture on the translucent screen, where again Mr. D'Orsay Bell is delightfully naïve in his dismissal of the difficulties.

In the circumstances, I regret that my article inspired Mr. D'Orsay Bell with nothing but torpor, but he must realise that I was competing neither with Mr. H. G. Wells or himself in the realms of chimeric fancy.

I note that Mr. D'Orsay Bell uses a new (to me) adjective, "visio." Recently the word "video" has come into use, particularly in America, for the description implied, and has much to recommend it on grounds of derivation alongside the now-accepted "audio," to say nothing of the equally accepted "radio," which has less derivational justification.

THE WRITER OF THE ARTICLE.

Valve Shy

I CANNOT quite understand your editorial comment headed "Valve Shy" in the issue of November 23rd.

The first half of the article you devote to impressing the reader on the cost attached to the early valve—"that precious article."

The purchasing power of money has changed, and in my opinion the present valve, with its rather limited life, is still a "precious article," and cost is still of paramount importance. By increasing the number of valves the number of stages is usually increased, and therefore the ultimate cost, and the man in the street is more concerned with this than with the slight added refinement which the use of extra valves would confer.

Undoubtedly two valves are usually better than one, but let the valve designers strive till they can make one valve do the work of two, and let the set designers endeavour to get the last ounce out of every valve, thereby keeping down the number and the cost—in other words, efficiency conscious, not valve shy.

Valve replacement cost in a modern receiver is as big an item as the costs attached to the early valve.

An editorial comment headed "Longer Life for Modern Valves" or "Closer Co-operation Between Valve Manufacturers with View to Better Standardisation and Fewer Types" would be welcome.

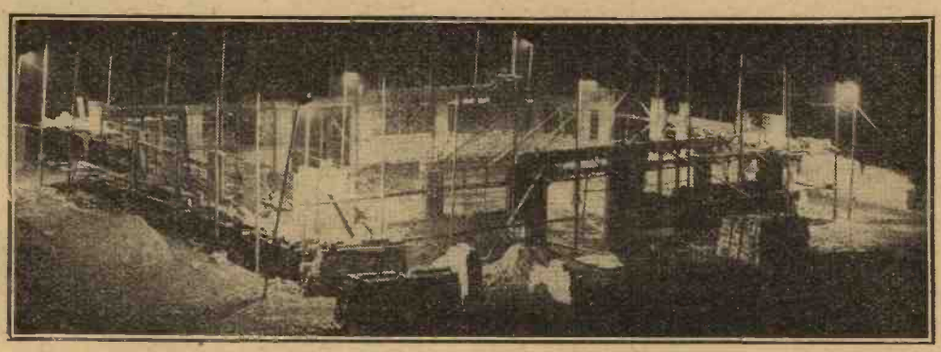
Dudley. L. C. HADLEY.

YOUR comments regarding the valve position are indeed welcome, and in the usual manner of your paper are fair comment on the one great weakness in the wireless industry of this country to-day. Too fair, perhaps, for if, as you suggest, the high prices are due to the cost of developing new and special valves, the purchaser gets surprisingly poor value for his money, for what new valves have been developed in this country? I rely on your pages for stating that most of the now more or less standardised types of valve were in general use in America before they were heard of here, i.e., screened grids, pentodes, and Class B's, whilst a feature of the "New Monodial" was an American heptode due to no British valve of similar type being available.

It would appear, then, that the cost is due to the pushing up of efficiency to extreme limits, and if two valves of ordinary efficiency could be produced for a price less than for one of high efficiency, it is more than time such production were started at drastically lower prices. W. J. S.

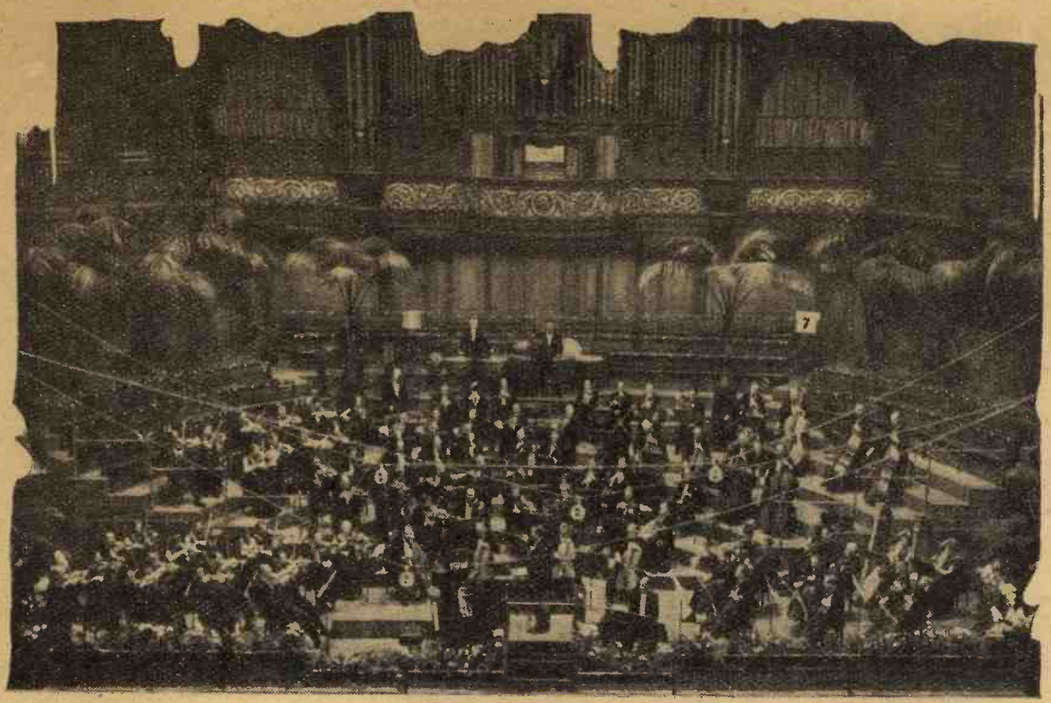
York.

A CAR RADIO FACTORY



NIGHT SCENE. Intensive work is going forward on the erection of a new Ekco factory, which, as briefly recorded last week, is to be devoted exclusively to the manufacture and installation of car radio sets.

★ ★ ★ Listeners' Guide

Outstanding

WINTER PROMENADE CONCERTS begin on Monday, December 31st (National, 8), under the direction of Sir Henry Wood, who is seen above with the Symphony Orchestra in the Queen's Hall. Soloists on Monday are Eva Turner, Parry Jones and Mahry Dawes.

SWITCH ON TO 1935.

NOWADAYS broadcasting is always the Master of Ceremonies. Whereas the New Year used to be celebrated by individuals, some staying at home and some parading St. Paul's Churchyard, now we cluster round loud speakers and celebrate *en masse*.

New Year's Eve is one of the B.B.C.'s big opportunities, and, from all accounts I have collected, Felix Felton (a newcomer to the Dramatic Department) will make the most of it in his feature programme, "Hail and Farewell." At eleven o'clock on Monday night the notes of Big Ben will precede a picturesque narration of happenings in 1934 by six narrators. Each voice will give its own colour to the tale of passing events. At 11.45 we shall hear a Watch Night service in Winchester Cathedral followed by the Westminster chime. Then, after a brief message to the world, the B.B.C. will close down on 1934.

THE NEW YEAR ABROAD.

IF, in some ways, it is disappointing that the B.B.C. should close down so soon after midnight, there is a bright side to the matter, for we shall be able to join in the merry-making abroad without the feeling that we are missing something at home.

Nearly all European stations have dance music until 2 a.m.; in some cases the fun goes on till 3 o'clock.

The German stations all begin their New Year programmes at 7 p.m. on December 31st with a musical feature entitled "A Good Journey into the New Year." At 11 p.m. Munich relays to all stations a short programme, "The Birth of the New Year," and after that the original feature will be resumed until 2.30 a.m. on January 1st.

WINTER PROMS AND SHAVIAN DRAMA.

Two big events of the coming week are the opening of the winter season of Promenade Concerts in the Queen's Hall, beginning with a Wagner night on December 31st, and two broadcasts of Part I of Bernard Shaw's "Back to Methuselah."

The "Proms," which will be a miniature version of the summer season, will, of course, be under the direction of Sir Henry Wood. At the opening concert (National, 8.0 p.m.) Eva Turner, soprano, will sing "Elizabeth's Greeting" from "Tannhauser."

GARDEN OF EDEN.

THE Shaw play, which was finely produced at the Court Theatre some ten years ago, is far too long for broadcasting in its entirety; the stage version occupied several nights and the audience were armed with season tickets! Cecil Lewis, who is producing the broadcast version, is wisely restricting the action to Part I, which will be broadcast on Wednesday (National, 8.15) and Thursday (Regional, 8).

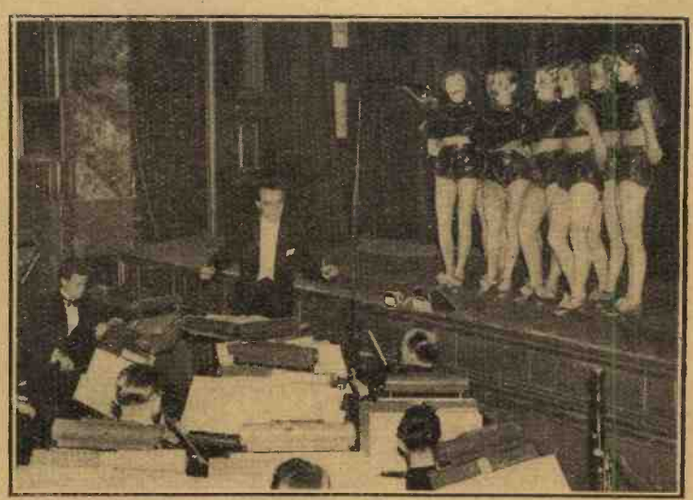
Mr. Bernard Shaw has given a new touch to the broadcast version by writing a special passage to link the Garden of Eden scenes with the reappearance of the ghosts of Adam and Eve at the end of the Pentateuch. Gwen Ffrangçon-Davies takes the part of Eve, Adam being represented by Robert Speaight.

OPERA.

LOVERS of opera and light opera have a varied choice during the next seven days. On Sunday evening at 8 p.m. the Deutschlandsender will be broadcasting "Die Lustigen Musikanten," a romantic musical play by Brentano adapted for broadcasting with music by E. Hoffmann. Then on Tuesday at 6.30 p.m. Prague will transmit the well-known opera, "The Secret," by her national composer, Smetana, relayed from the National Theatre.

Those who prefer something in lighter vein can tune in during the same period to Warsaw (7.15 p.m.) for Stolz's operetta "Only Another Night."

On the next evening at 8.30 Strasbourg P.T.T. will offer us Rousseau's comic opera "The Village Seer."



THE DANCING DAUGHTERS photographed during an actual broadcast in St. George's Hall, with Kneale Kelley wielding the baton. Their next appearance is in to-morrow night's "Music Hall" (National, 8.30), with Les Allen and His Melody Four, Wilkie Bard and other favourites.

for the Week

Broadcasts at Home and Abroad

MUSIC FOR MODERNS.

THOSE who like modern music have a choice of two promising programmes this week, the first from Munich at 10 p.m. on January 2nd, when works by young German composers will be broadcast, and the second, at 8.20 p.m. on Thursday, when Copenhagen will give a concert of contemporary music.

LES ALLEN AGAIN.

A MAJOR attraction in tomorrow night's "Music Hall" (National, 8.30) will be the appearance of Les Allen and his Melody Four. Since he left the B.B.C. Dance Band Les Allen has made many public appearances, but this will be the first time that he and his team have appeared on the stage of St. George's Hall.

Another popular figure will be that famous comedian Wilkie Bard.

HECKLING THE PROPHETS.

MR. R. WATSON WATT needs no introduction to the majority of readers of *The Wireless World*, to whom he is well known as a member of the Radio Research Board and contributor to this journal. He appears in a new rôle in the Regional programme at 8.30 to-morrow evening as a member of the "cast" of a feature programme, "Here are the Prophets." It will be in no spirit of rashness that this meteorological and radio expert will attempt to foretell the weather of 1935.

His colleagues will include Sir Malcolm Campbell, prophesying the outcome of the traffic problem; Geoffrey Crowther foretelling the trend of economic development; Ritchie Calder dealing with medical science in the New Year; and Madge Garland (Fashion Editor of *Vogue*) predicting women's fashions. The *compère* in this daring production will be Mr. J. L. Hodson, who will extract all the prophecies he can, whether his victims like it or not.

TO PLEASE EVERYBODY.

IVY ST. HELIER and Dick Francis are to *compère* a programme on Thursday next (National, 7.30), which will set out to please everybody—high-, middle-, and low-brows. Entitled "Entre Nous," or "Let's Sing Something," this feature will include songs of all kinds, with artists of the calibre of Stuart Robertson and Esther Coleman. The production will be in the hands of Gordon McConnel, who, if he *does* please everybody, will deserve a Director-Generalship.

VIENNA RELAY ON SUNDAY.

EUROPE'S land-lines are so good nowadays that little is lost in a musical transmission cabled right across the Continent. Lovers of Viennese music should not miss the relay from Vienna of the "Strauss to Lehar" programme at 6.30 on Sunday (Regional). The Viennese Wireless Symphony Orchestra will be playing under the baton of Josef Holzer.

WHEN THE B.B.C. CLOSES DOWN on New Year's Morn this hot dance band at Copenhagen (Louis Preil's) will be broadcasting American and British numbers until 1 a.m.

HANSEL AND GRETEL.

A FAIRY tale opera on Sunday evening! What a chattering this would have aroused a few years ago; yet no one will criticise the inclusion of Humperdinck's delightful "Hansel and Gretel" in the National programme at 9 on Sunday next.

Although described as a Children's Opera, "Hansel and Gretel" contains music to satisfy the maturest musician. It has been prepared for broadcasting by Derek McCulloch, and the orchestra will be directed by Stanford Robinson.

DENMARK TO THE RESCUE.

LISTENERS making merry after 12.5 on New Year's morning need not regret the closing down of the B.B.C. stations, for a very "English" dance orchestra will be playing at Copenhagen until 1 a.m. This is Louis Preil's dance orchestra, which makes a feature of British and American tunes, sung in English or a near equivalent.

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, DEC. 28th.

Nat., 7.35, Kentucky Minstrels. 8.35, Concert of British Music by B.B.C. Orchestra (Section C).
London Reg., 8, "Oliver Twist."
Abroad.
Breslau, 8, Opera "La serva padrona" (Pergolesi).

SATURDAY, DEC. 29th.

Nat., 8.30, "Music Hall," with Les Allen and Wilkie Bard. 10, B.B.C. Organ Recital—VI by Maurice Vinden.
London Reg., 8.30, "Here are the Prophets."
Abroad.
Copenhagen, 9.15, English and American Music.

SUNDAY, DEC. 30th.

Nat., 3.45, The Serge Krish Septet. 7.5, Recital by John Coates (tenor) and Samuel Kutcher (violin). 7.55, Service in Canterbury Cathedral with address by the Archbishop. 9, Opera, "Hansel and Gretel" (Humperdinck).
London Reg., 4.30, The Palladium Orchestra. 6.30, "Strauss to Lehar," relayed from Vienna. 9, "American Points of View," a talk by Prof. W. H. Hamilton. (from America).
Abroad.
Vienna, 8.5, Symphony Concert.

MONDAY, DEC. 31st.

Nat., 8, Opening Concert of Winter "Proms," Queen's Hall. 11, "Hail and Farewell."
London Reg., 7.30, Fred Hartley and his Novelty Quintet. 9, The Air-do-Wells, 4th Edition. 10.10, B.B.C., Theatre Orchestra. Soloist: Peter Dawson.
Abroad.
All German stations, 7, "A Good Journey into the New Year."

TUESDAY, JAN. 1st.

Nat., 8.15, "The Night Sky"—III. 8.30, Songs from the Films—V, with Anona Winn, Brian Lawrence, Michael Cole, Max Kirby. 10, "India" by Rt. Hon. Sir Samuel Hoare.
London Reg., 7, "Aladdin" from the Prince of Wales' Theatre, Birmingham (from Midland Regional). 8, Promenade Concert.
Abroad.
Langenberg, 7.15, New Year Symphony Concert.

WEDNESDAY, JAN. 2nd.

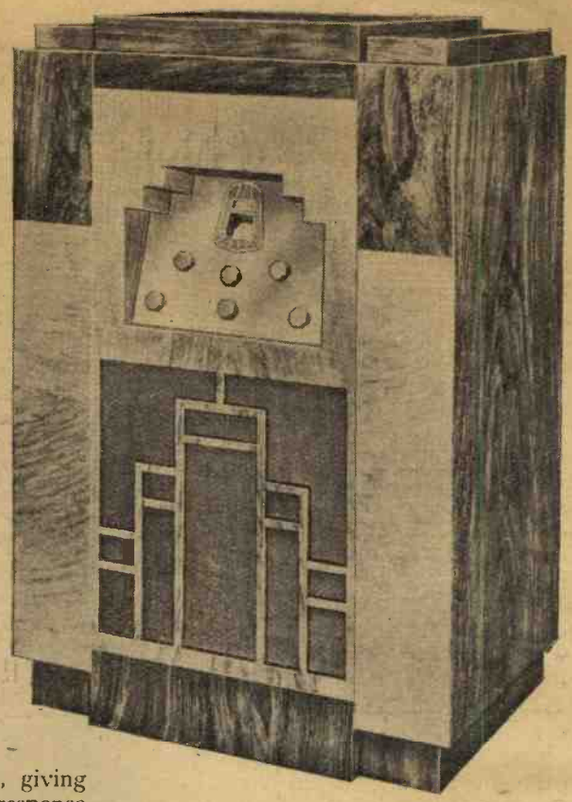
Nat., 7.30, B.B.C. Organ Recital—VII, by Thalben-Ball. 8.15, "Back to Methuselah"—Part I, by G. B. Shaw, produced by Cecil Lewis.
London Reg., 7, Lady Tree in "Carriages at Midnight." 9, B.B.C. Midland Orchestra (from Midland Regional).
Abroad.
Strasbourg, P.T.T., 8.30, "The Village Seer"—a comic opera by Rousseau.

THURSDAY, JAN. 3.

Nat., 8.30, Pianoforte Recital by Moisewitsch. 9.10, "Soft Lights and Sweet Music."
London Reg., 6.30, Callender's Band. 8, "Back to Methuselah."
Abroad.
Copenhagen, 8.20, Modern Music.

B.S.R. Radio-gramophone MODEL VS8

Continuously Variable Selectivity : Moving-Coil Horn Loud Speaker for High Frequencies

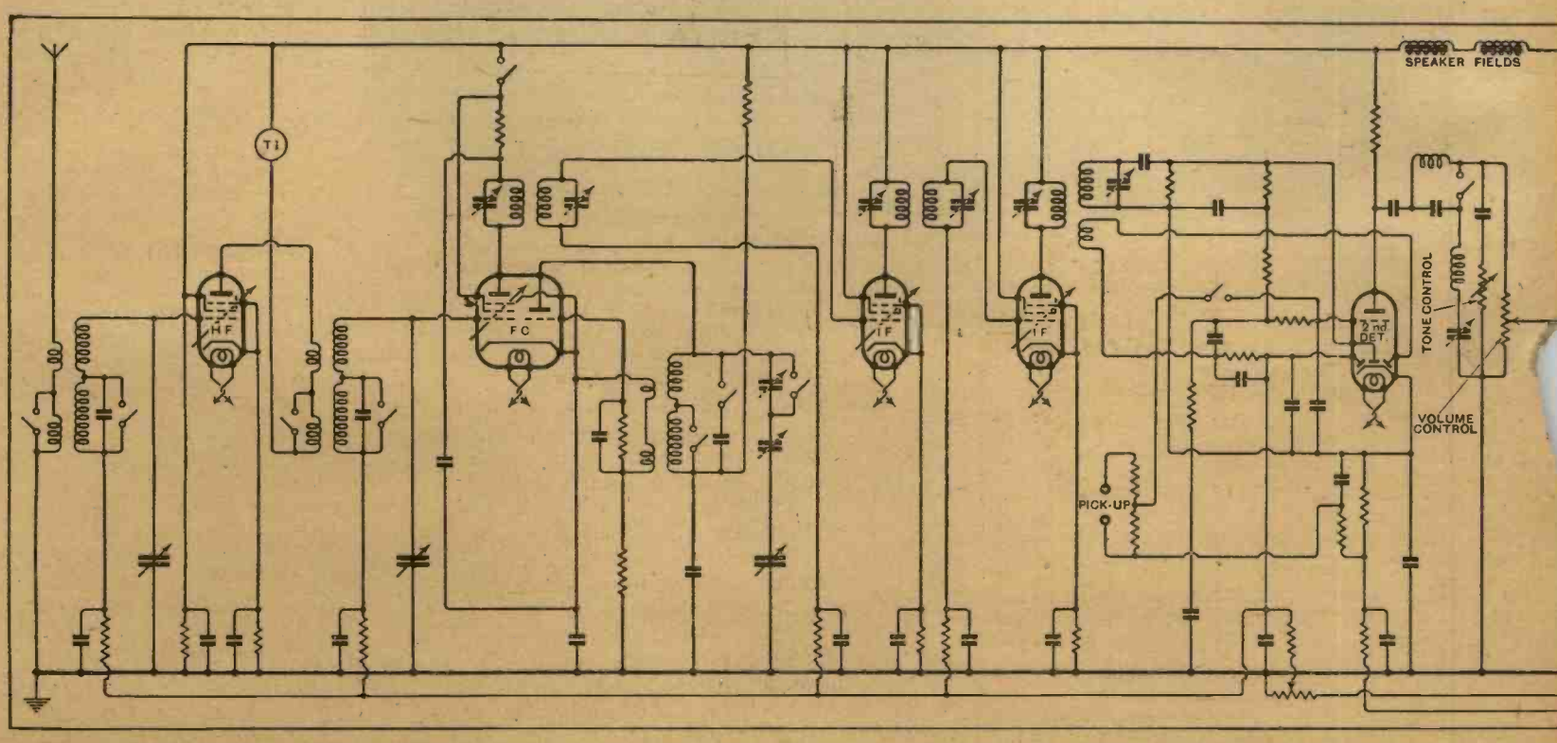


FEATURES.—***Type.***—*Superheterodyne radio-gramophone for AC mains incorporating automatic record changer.* ***Circuit.***—*Var.-mu pentode HF amplifier—triode-pentode frequency changer—two stages of IF amplification—triple-diode-triode 2nd detector—triode LF amplifier—triode power output valve. Full-wave valve rectifier.* ***Controls.***—*(1) Tuning, with meter-type tuning indicator. (2) Volume control and on-off switch. (3) Selectivity control. (4) Tone control. (5) Noise suppressor. (6) Waverange switch.* ***Price.***—*85 guineas.* ***Makers.***—*Birmingham Sound Reproducers, Ltd., Claremont Street, Old Hill, Staffs.*

IT has already been established that there is a surprisingly good market for radio-gramophones in which no expense is spared in providing the highest possible performance with the means at present at the disposal of designers. The B.S.R. Model VS8 incorporates most of the features which are regarded as belonging essentially to this type of instrument, and not the least interesting is the method which has been adopted to obtain a continuously variable control of selectivity.

This has been achieved by varying mechanically the coupling between the primary and secondary windings of the three IF transformers. A push-pull control on the front panel with a movement of approximately 1 inch actuates a rod which runs from back to front of the underside of the chassis and to which the IF transformer coils are coupled by means of suitable links. With the control fully extended a narrow single-peaked resonance curve is obtained which gives a high degree of selectivity for the reception of distant stations. When pushed fully in a double-humped resonance curve is obtained with a band width of approximately 24 kc/s, giving a theoretical audio-frequency response up to 12,000 cycles. Between these limits the control can be adjusted to give the highest possible quality of reproduction consistent with the receiving requirements from the point of view of selectivity.

The operation of this control is most fascinating, and if a heterodyne whistle or any other form of HF interference is present, the selectivity can be adjusted exactly to the point where the extraneous noise disappears. It is advisable, however, before experimenting with the selectivity control to tune in the receiver accurately to the station required with the highest degree of selectivity, other-



A signal-frequency amplifier and two IF stages provide a high degree of range and selectivity. The coupling of the IF circuits is adjustable, as is the

wise any movement of the selectivity control may result in apparent mistuning. For instance, if the set is carelessly tuned to the local station with the lowest degree of selectivity and the selectivity control is then pulled out, it often happens that the local station disappears and another station on an adjacent channel takes its place. However, this will not happen if the correct procedure is adopted. Incidentally, in the receiver tested it was observed that with the broadest tuning the double humps of the response were not quite symmetrical, and best results from the point of view of quality were obtained with the control pulled out about a quarter of its total distance from the low selectivity position.

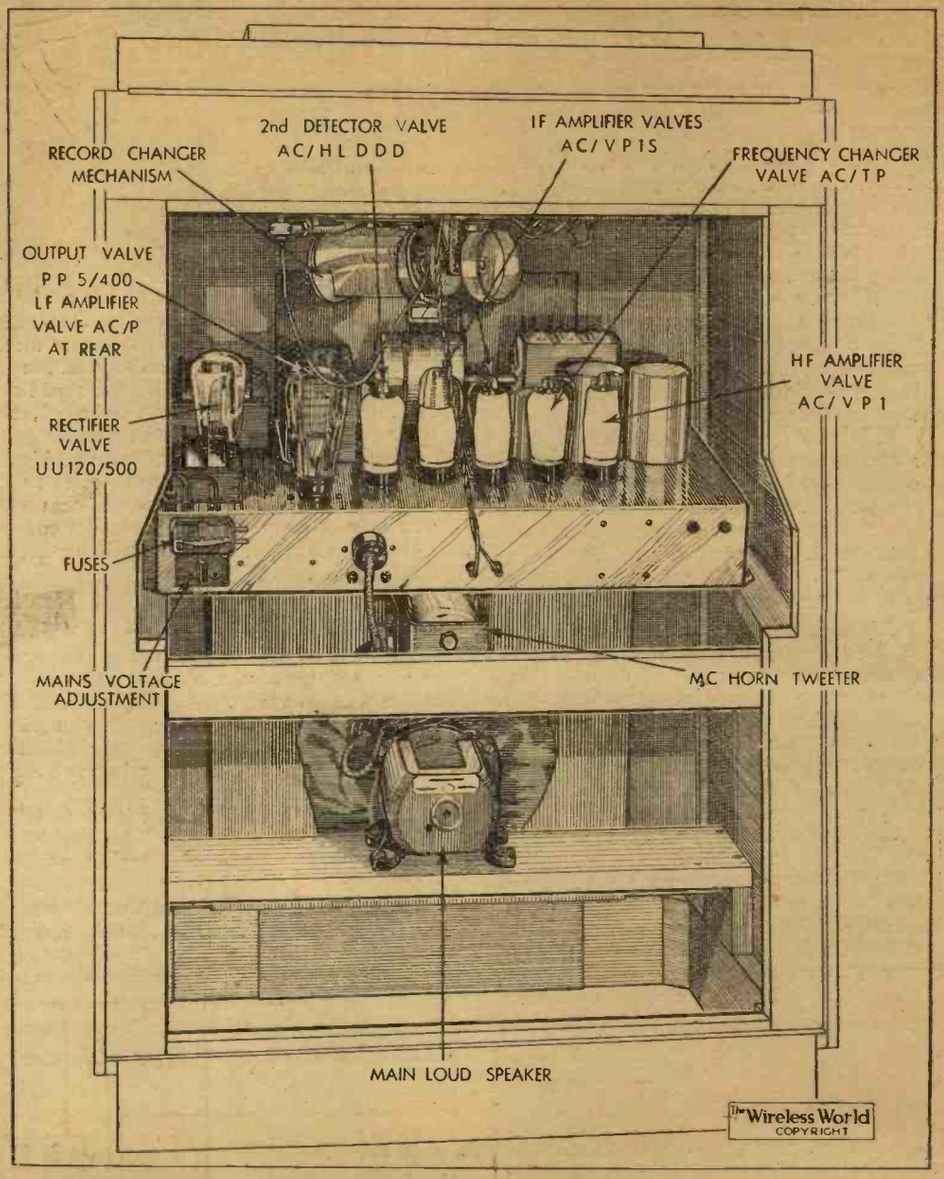
High Note Response

In order that full advantage may be taken of the wide audio-frequency response of which the receiver is capable, a horn-type moving-coil high-frequency unit is connected in parallel with the main moving-coil loud speaker through a suitable condenser by-pass. The model tested was also fitted with a variable resistance in series with the speech coil of the high-frequency unit in order that a balance of tone best suited to individual requirements could be obtained.

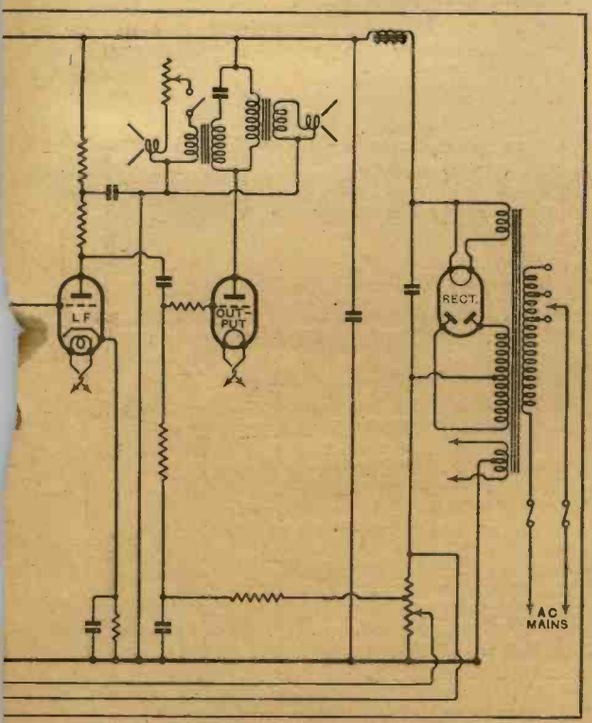
Most of the output from the high-frequency unit appears to be in the region of 2,000 to 6,000 cycles which is usually left to the larger loud speaker, but there is sufficient response above 6,000 cycles to give the characteristic harmonic and transient effects which one expects from a combination of this type.

The sensitivity of the set is of a high order, and this is probably due to the fact that in addition to two IF stages there is a signal frequency amplifier preceding the triode-pentode frequency changer. The second detector is of the triple-diode-triode type which is arranged to give amplified and delayed AVC and inter-carried noise suppression in addition to signal rectification. The triode portion of the valve is used in the AVC circuit as well as for LF amplification, and a third winding on the IF transformer supplies the signal EMF. A separate triode amplifier precedes the PP5/400 output valve, and tone correction circuits are included in the coupling from the second detector valve. There is an additional control of the AVC delay voltage which enables the sensitivity of the receiver to be reduced where background noise is troublesome.

The gramophone pick-up is of the piezo-electric type, and both the volume and tone controls remain operative when the instrument is switched over from radio to gramophone. An automatic record changer is fitted as standard. The cabinet is rigidly constructed, and the walls are lined with sound-absorbing material to obviate box resonances. The control panel is inclined, and is finished in Florentine bronze, while the contrasting walnut veneer panelling gives the set a striking appearance.



Interior of the cabinet showing rigid cross-bracing. The sides are lined with absorbent material to prevent box resonance.



balance of output from the dual loud speaker units.

THE RADIO INDUSTRY

A leaflet received from Wolsey Television, Ltd., of Guildford House, 54, Lamb's Conduit Street, London, W.C.1, describes an inexpensive kit of parts for a television receiver.

◇ ◇ ◇ ◇

Recently introduced models are described in a new Ferranti catalogue which deals with receivers, radio-gramophones and loud-speakers. Address: Ferranti, Ltd., Hollinwood, Lancs.

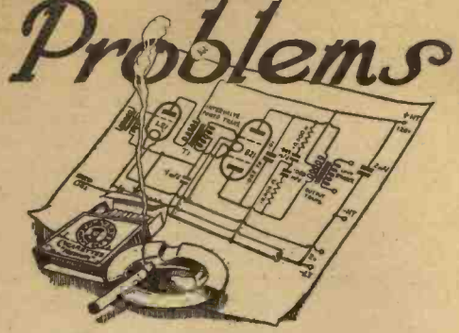
◇ ◇ ◇ ◇

Ward and Goldstone, Ltd., Pendleton, Manchester, are producing special coils for the latest Single-Span receiver. These, either separately or mounted as units, are described in a list just issued.

◇ ◇ ◇ ◇

A disadvantage of the usual metallising process as applied to valve bulbs is that the surface soon becomes dirty and unsightly. The makers of Tungsram valves have overcome this difficulty by spraying on a top coat of special varnish which protects the metal under-coat.

Readers' Problems



THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Ganged Coils

THE tuned sections of all the HF coils of a modern receiver are, to the eye, identical in size and windings. But there is no technical reason, from the point of view of accuracy in circuit alignment in gang-tuned receivers, why they should be so, although the use of assorted coils of different types would doubtless complicate the processes of manufacture.

This point is raised by a querist who asks whether it would be possible to attain accurate ganged tuning with coils of widely different self-capacity.

Provided that the inductance values of all coils are identical, differences in self-capacity are not of necessity harmful, as they can be compensated for by suitable adjustment of the trimming condenser associated with each circuit.

Band-pass Detector Sets

IT is a demonstrable fact that a detector-LF set with band-pass tuning is almost immeasurably superior in apparent selectivity to one with a single-tuned circuit. But it would appear (*vide* our recent Guide to Receivers) that not a single commercial set of this type is produced. (By detector-LF set we mean one without either HF amplification or a superheterodyne circuit.)

Cost and operating difficulties account for the lack of popularity of band-pass detector sets; the latter drawback is especially evident when reaction is used, as a querist has found out by experience.

The main trouble is that reaction control becomes erratic at times, especially when the tuning of the component circuits of the filter is out of alignment. Our correspondent would probably be well advised to increase the flexibility of his circuit by modifying it to the arrangement shown in Fig. 1, which provides variable filter coupling and an external trimmer for ensuring perfect alignment. The golden rule in operating such a receiver is always to reduce reaction before touching the coupling or trimming controls; a reduction in coupling or a movement of the trimming condenser in the wrong direction may otherwise cause self-oscillation by lightening the load on the detector grid circuit. If this point is borne in mind, the necessary skill will soon be acquired.

The special arrangement of twin grid leaks shown in our diagram, though not essential to the circuit, is recommended because it will help to ensure smooth reaction control—a matter of some importance in a receiver of this type.

Tactual Tests

WHEN certain of the high-frequency components of a receiver are touched, all sorts of things may happen, and it is not often that one can place much confidence on the effects observed as an indication whether the circuit is behaving normally. There are so many complicating factors that it is impossible to lay down hard and fast rules.

However, it seems probable that an effect described by a querist can have only one interpretation. It is stated that on touching the grid terminal of the second HF valve of a "straight" receiver, a distinct improvement in signal strength is obtained at almost any wavelength.

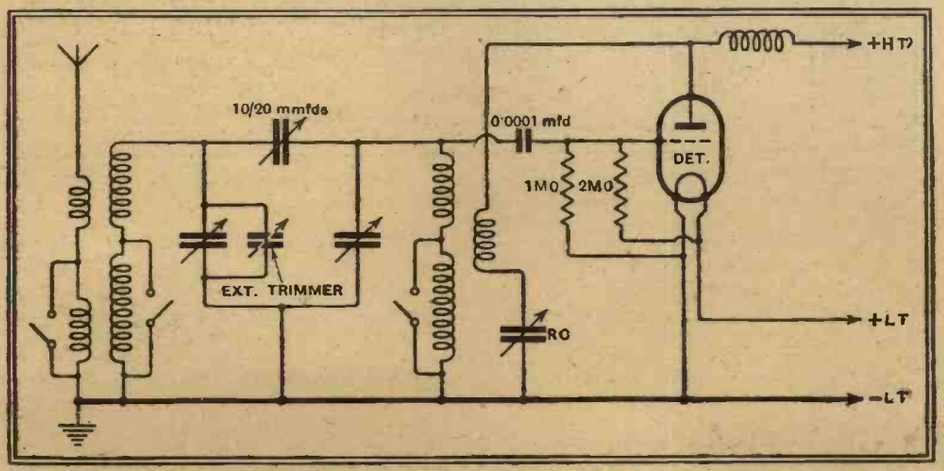


Fig. 1.—Suggested alterations to a reader's band-pass circuit; external coupling and trimming controls ensure best operating conditions.

In all probability the tuning of the grid circuit of the valve in question is out of alignment with the other circuits. Very possibly the trimming condenser has been set at maximum and actually extra capacity is needed in this circuit. This state of affairs may have arisen merely because an excessive amount of trimming capacity has been used throughout, and it would be a good plan to re-align the circuits completely.

In making these statements it is assumed—we think logically—that the addition of body capacity to the circuit brought about by touching the terminals happens to bring the circuit more nearly into alignment. In a few cases, an effect similar to that described may be traced to a choked grid circuit caused by the failure of a grid leak or by a disconnection. Naturally, such a fault is only to be expected when a condenser is connected in series with the grid of the valve; in this case the effect of touching the grid terminal is to provide an artificial leak through the body to earth.

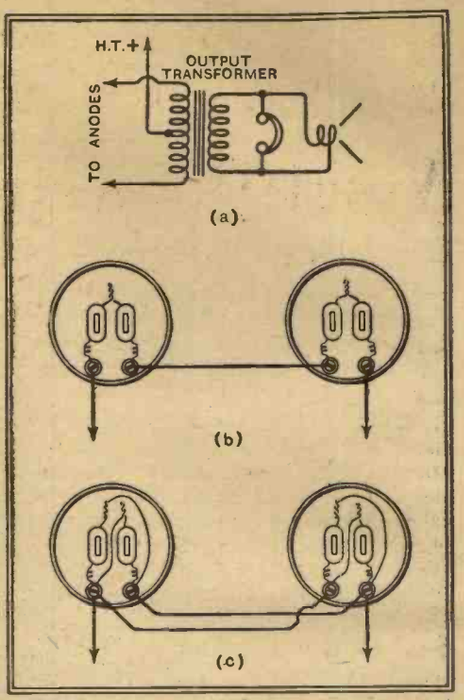


Fig. 2.—Connecting headphones to a QPP output stage, and (below) normal and suggested parallel connections of phone bobbins.

Headphone Listening

FOR the benefit of a deaf listener a reader wishes to connect a pair of headphones to the QPP output stage of his receiver. The phones in use are of 120 ohms resistance, and it has been found that, by joining them across the secondary of the output transformer (see Fig. 2 (a)), signals are obtainable, but volume is insufficient.

The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

Readers' Problems—

It is asked whether volume could be increased sufficiently by joining the two earpieces in parallel, thus reducing impedance and ensuring that a larger proportion of the available energy may flow through the phones.

We doubt if impedance will be sufficiently reduced by this alteration, but suggest that if the four individual magnet bobbins were joined in parallel, passable results should be obtained. Most phones are so constructed that the alterations may be carried out quite easily, but a certain amount of care must be taken to avoid polarity reversals. We are accordingly giving two skeleton diagrams (Figs. 2 (b) and (c)) showing connections before and after the alteration.

Hot Resistors

A CORRESPONDENT seems to be under the impression that a fixed resistor is to some extent a self-compensating device; as current increases, the resistor becomes warm and its ohmic value rises, thus tending to restrict any departure from normal working conditions.

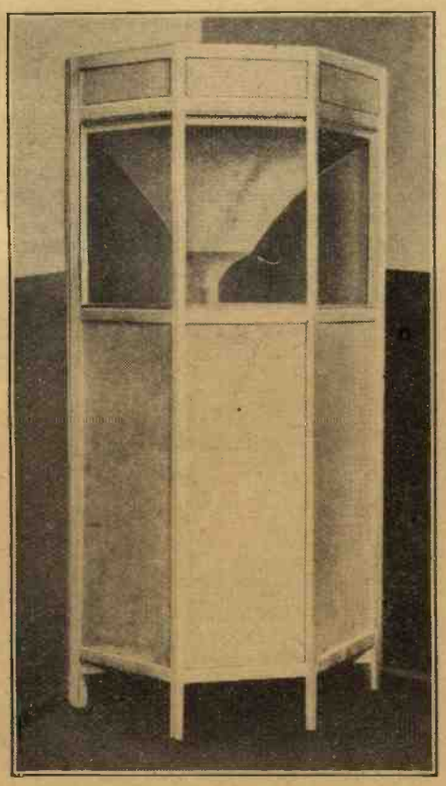
So far as the popular moulded or composition resistors are concerned, this idea is fallacious; their resistance value *falls* with increase of temperature. Wire-wound resistors, however, have what is known as a positive temperature coefficient, and behave in the manner described by our correspondent. But in practice the rise of resistance is insufficient to bring about anything approaching automatic regulation.

Voigt Domestic Loud Speaker

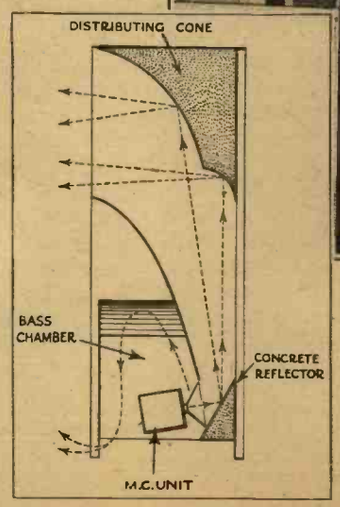
Construction and Performance of the Latest Corner Cabinet Type Horn

THE VOIGT twin-diaphragm moving-coil unit in conjunction with the 4ft. "Tractrix" horn has already established a reputation for natural reproduction and high electro-acoustic efficiency. Unfortunately its size has precluded its use for broadcast reception in the home. This difficulty has now been overcome and in the latest Voigt "Corner Reflector" loud speaker a comparable performance is obtained from an instrument which will fit conveniently into the corner of even a small living-room.

Briefly, the principle underlying the new speaker may be stated as follows. Starting first with the original square-section horn with 4ft. mouth, imagine that instead of the single unit at the throat we install four units at a point where the cross-sectional area is sufficient to accommodate them. A slight decrease of the diaphragm amplitude equivalent to the expansion due to the first section of the horn will give the same effect at the mouth as the single unit, and we have at the same time reduced one dimension, namely, the overall length of the horn. Now if the horn were divided into four parts by thin rigid partitions intersecting at right angles on the axis, due to the symmetry of the wave front, an observer situated at any point in front of the horn would notice no change in sound output whether the partitions were in position or not. It follows that if he were opposite one of the sections, the remaining three together with their units could be removed without affecting the result.



Designed to fit into a corner of the room the latest Voigt domestic speaker has similar characteristics to those of a 4ft.-mouth horn.



Front panels removed giving access to the bass-chamber and twin-diaphragm unit, and (left) diagrammatic section of cabinet, showing alternative sound paths.

In effect, this is what has been done in the "Corner Reflector" type loud speaker, the right-angle partitions being arranged to fit into the corner of the room. To enable the moving-coil unit to be mounted horizontally a 45-degree concrete reflector is fitted in the base to deflect the sound upwards, while a curved reflector is situated in the roof of the cabinet to distribute the sound horizontally through 90 degrees and to give also some vertical dispersion. In designing the curvature of this reflector special attention has been given to the distribution of the higher frequencies which are concentrated near the axis of the vertical section of the horn.

Improved Bass Response

An improvement in the response below the theoretical bass cut-off of the horn (about 100 cycles) has been brought about by fitting what is termed a "bass chamber" in the spare space behind the panels. This chamber, which is driven from the back of the diaphragm, is divided into two sections, and the weight and dimensions of the air column have been calculated to give effective radiation over a band of frequencies immediately below the horn cut-off. The low notes, being nearly free from directional effects, blend smoothly with the main output.

Our own tests showed that the high electro-acoustic efficiency of the original horn type is maintained and the volume level for a power input of 2 watts was more than most people would require in a living-room of average size. The bass chamber gives an effective extension of the frequency response in the bass down to 40 cycles without any suggestion of resonance. A peak was observed, however, at 125 cycles, but this was probably due to the fact that one of the walls forming the corner was a glass-panelled partition and therefore not quite rigid. Another slight resonance, too small to affect the general result, was noted at 2,800 cycles. Otherwise the response up to 8,500 cycles was sensibly uniform. The unit possesses all the good qualities of attack and transient response noted in the full-sized horn and there can be no doubt that this loud speaker sets a standard which has hitherto seldom been reached in domestic equipment.

The price of the cabinet alone in untreated wood is £14 5s., and a variety of finishes are available at extra cost. The twin-diaphragm unit is sold separately at £15 and the makers' address is Voigt Patents, Ltd., The Courts, Silverdale, London, S.E.26.

Foundations of Wireless

Part VI.—Phase : Reactance and Resistance in Combination

By A. L. M. SOWERBY, M.Sc.

THE relationship between current and voltage in AC circuits is discussed, and the distribution of voltages in relatively complex resistive-capacitative circuits (of the type found in wireless apparatus) is described.

(Continued from page 541 of December 21st issue)

IN the preceding instalment, in which we discussed the passage of alternating current through a condenser and through an inductance, we saw, by means of a purely qualitative mental picture of the storage of energy in magnetic and electric fields, how a current could pass through either of these without dissipating energy. In order to make it possible to consider combinations of unlike impedances (L and R, C and R, and, finally, L and C) in the same circuit, we must elaborate this mental picture enough to see the relationships of current and voltage that are necessary to enable this *wattless current* to pass.

In Fig. 26 the upper full line represents an alternating potential of RMS value 1 volt. If this is applied to a 2-ohm resistance the current will be E/R=0.5 amp. RMS. We have already seen that in a circuit consisting of pure resistance the current adapts itself instantaneously to changes in voltage; we may therefore apply Ohm's Law to each momentary voltage all through the cycle. By doing this we arrive at the dotted curve, which shows the current in the circuit at every instant. At the beginning of the cycle (at 0°) the voltage and current are both zero; at 90°, the end of the first quarter-cycle, both are at their maximum in a positive direction, dropping again to zero half-way through the cycle (at 180°), and rising again to a maximum in the negative direction.

Having thus drawn out voltage and current separately for each instant, we can calculate, by simple multiplication of one by the other, the power being consumed. At 0°, for example, E and I are both zero; so therefore is the power. At 30° E=0.707, I=0.353; hence the power, EI, is 0.25 watt. Proceeding in this way for a number of points distributed over the first 180° of the cycle we find that the power rises to a maximum at 90°, and then falls again to zero, as the lower curve of Fig. 26 shows. In the next half-cycle, 180° to 360°, voltage and current are both negative; their product is, therefore, still positive. A second rise and fall of wattage, exactly equal to that of the first half-cycle, will, therefore, occur.

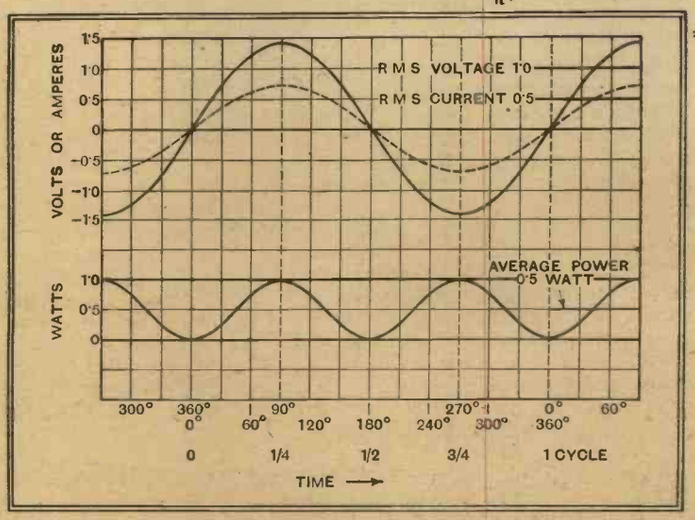


Fig. 26.—Relation of voltage, current, and power in a purely resistive circuit. Note that the complete cycle is indicated in degrees for easy reference.

In a resistive circuit, then, the power rises and falls once every half-cycle of the applied voltage. But it remains always positive, so that at every individual instant (except at 180° and 360°) power is being consumed in the circuit. RMS voltage and current, and average power, are marked on the curves; it will be seen that, as already explained, the calculation of average power from RMS voltage and current, or from either of these and the value of resistance in the circuit, is worked out exactly as for direct current.

It will be clear from Fig. 26 that so long as voltage and current rise and fall together, as in these curves, their product will remain positive at every instant. This relationship of current and voltage, therefore, cannot apply to wattless circuits (inductance or capacity alone). In such circuits it is evident that the two must be out of step.

In Fig. 27 is repeated the full-line voltage-curve of Fig. 26, but this time there is associated with it a current-curve displaced by 90°, or one-quarter of a cycle, towards the left. To calculate the power consumed with this new relationship between voltage and current we have, as before, to multiply corresponding pairs of values and plot the result. This leads to the lower full-line curve of this figure.

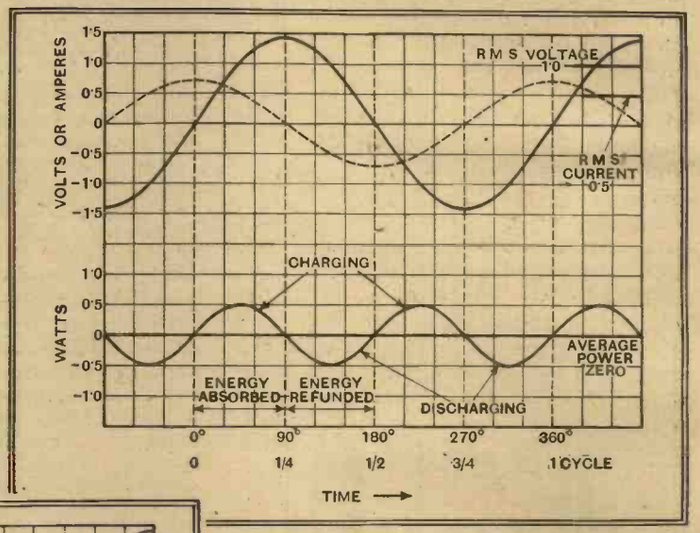


Fig. 27.—Relation of voltage, current and power in a purely capacitative circuit. Note that the average power is zero, and compare Figs. 26 and 28.

from which it will be seen that the power is positive (i.e., absorbed) for the first quarter-cycle from 0° to 90°, is negative (i.e., evolved) for the next quarter-cycle from 90° to 180°, and so continues alternately positive and negative. This would correspond satisfactorily with the conditions known to hold when an alternating voltage is applied to a condenser or an inductance, energy being alternately stored in and returned from the electrostatic or magnetic field.

The curves shown actually represent the case of the condenser, as can be seen if we remember that at every instant the voltage across it is that of the full-line curve. For the condenser always to maintain this voltage, current must flow into it fastest when the voltage is changing most rapidly, and the direction of the current must always be that towards which the

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voltage is tending. As the slope of the full-line curve shows, the voltage is changing most rapidly (steepest slope) at 0° and 180°. At these points the current has its greatest values; at 0° it is positive, and the voltage is running up towards its positive peak as required by the condition just laid down. Similarly, at 180° the current has its greatest negative value, while the voltage is changing at its fastest in running towards its negative peak, and the condenser, having just lost a charge, is on the verge of acquiring one in the opposite direction.

In the case of the resistance (Fig. 26) the current rises and falls exactly in step with the voltage driving it. The technical description of this is that the two are "in phase." This is not true of the current and voltage of Fig. 27; here the current reaches its maximum a quarter of a cycle before the voltage. The two are here "out of phase," the "phase displacement" amounting to 90°. The current, since it arrives at its maximum before the voltage, is said to be a "leading current."

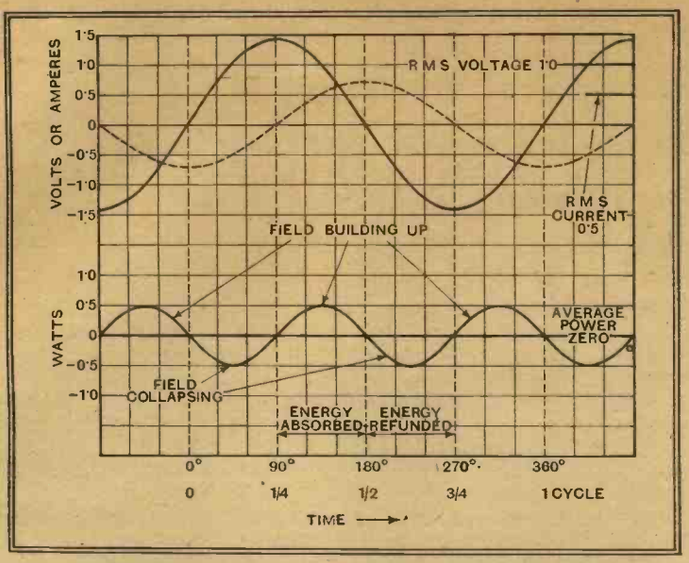

Fig. 28.—Relation of voltage, current and power in a purely inductive circuit. Note that the average power is zero, and compare Figs. 26 and 27.

If we displace the current-curve by 90° to the right instead of to the left of that representing the voltage, we arrive at the diagram of Fig. 28. Here, again, the power is alternately positive and negative, making, as before, an average of zero power over the complete cycle. These curves show the relationship between voltage and current that is found when the circuit consists of pure inductance. We have already seen that the need for building up the magnetic field round the coil slows the growth of the current, while its collapse tends to maintain the current for an instant after the voltage driving it is removed. Examination of the curves of Fig. 28 show that they fulfil just these conditions, the current rising and falling always later than the voltage. At 180°, for example, the current is flowing in a positive direction even though the voltage has dropped to zero. The current is in the direction in which the voltage was urging it a quarter of a cycle earlier.

As in the case of the capacitative current, there is a phase-difference of 90° between current and voltage, this being the necessary condition for a wattless current. In the present case the current is known as a "lagging" current, for the reason that it reaches each maximum a quarter of a cycle after the voltage. By itself the phase-relationship between current and voltage is of minor importance in wireless work, and we shall make no attempt to wade through, even in abbreviated form, the discussions on phase-angles and power-factor that occupy so great a space in most text-books on alternating currents. Instead, we will go straight on to see the effect of leading or lagging currents in slightly more complex circuits.

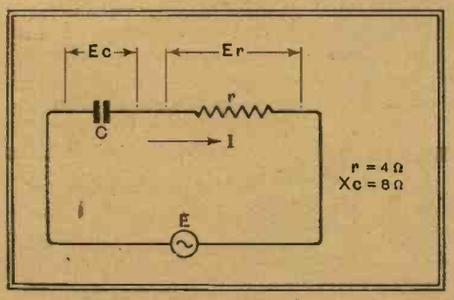

Fig. 29.—Condenser and resistance in series with an AC source. The generator-voltage E is equal to the total voltage due to the simultaneous presence of Ec and Er. See Fig. 30.

Suppose a resistance and a condenser are connected in series, and an alternating or high-frequency potential is applied across the whole, as in Fig. 29. It is evident that a current will flow, and that, since this current consists of the physical movement of electrons, it will be the same at all parts of the circuit at any one instant. A voltage, in phase with the current, will be developed across the resistance; if the peak value of the current is 0.25 amp., as shown dotted in Fig. 30, the potential difference will rise to a maximum of 1 volt. This PD is shown as a full-line curve marked Er. Similarly, the current will develop a potential difference across the condenser; this, however, will be 90° out of phase with the current, as shown by the full-line curve Ec. Its maximum of 2 volts, therefore, does not coincide in time with the maximum of the voltage across the resistance.

Distribution of Voltage

The total voltage across the two circuit elements, which is, of course, equal to the voltage of the generator, must at every instant be equal to the sum of the two separate voltages, and can be found by adding the heights of the two curves point by point over the cycle. (The term "adding," it is to be noted, may mean "subtracting" in the sense that +1 v. and $-\frac{1}{2}$ v. add up to $+\frac{1}{2}$ v. by subtracting the negative half-volt from the positive volt.) The result of this addition is shown in the bottom curve of Fig. 30.

It will be noticed that this total voltage has a phase between those of the two component voltages from which we have built it up; it is some 63° out of phase with the current. Further, the maximum voltage is not the sum of the two separate peak voltages, because these do not occur at the same instant, but, as it rises to 2.24 v., it is larger than either alone.

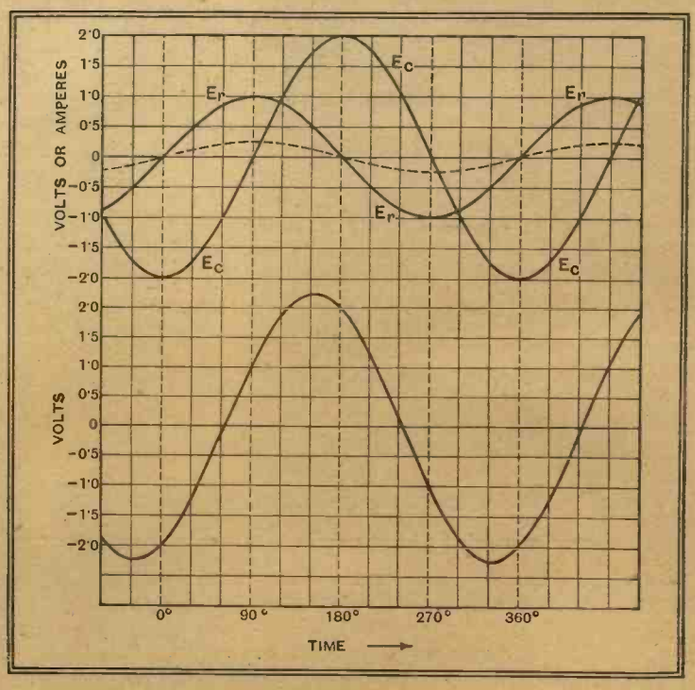

Fig. 30.—In the upper curve, Er represents voltage across the resistance, and Ec voltage across the condenser, of Fig. 29. The lower curve shows the resultant total voltage; that which the generator must have to drive 0.25 amp. through the circuit.

We are now in possession of the information that an alternating voltage of 2.24 v. drives a current of 0.25 amp. through a resistance of 4 ohms in series with a con-

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denser of reactance 8 ohms. The total impedance of resistance and condenser taken together is defined by clinging to the outward form of Ohm's Law and saying that the impedance Z of the circuit shall be equal to the voltage divided by the current; i.e., $I=E/Z$ instead of $I=E/R$, as in the simple case of direct current. In our present case $Z=E/I=2.24/0.25=8.94\Omega$. The two components of the impedance, 8Ω reactance plus 4Ω resistance can obviously not be combined by simple addition to form this value of

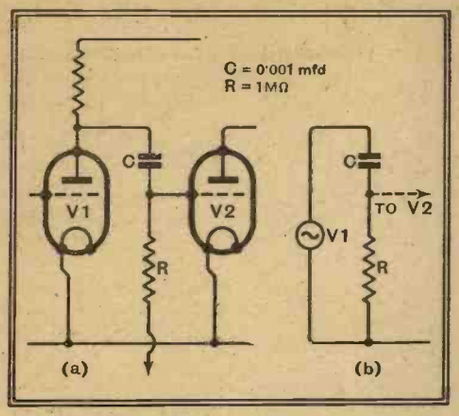


Fig. 31.—A low-frequency coupling between two valves. Diagram *a* shows the practical circuit and *b* the essentials necessary to calculation.

impedance, but it can be shown that a pure resistance r and a pure reactance X in series make up a total impedance Z which is given by $Z^2=X^2+r^2$. In our example, $Z^2 = 8^2 + 4^2 = 64 + 16 = 80$, whence $Z=8.94\Omega$, as already found. An impedance worked out in this way can always be used in the "Ohm's Law" formula $I=E/Z$ to find the magnitude of the current that will flow on the application of a known voltage.

Let us apply this to a case of wireless interest. Fig. 31*a* represents a coupling between two successive valves in a receiver, and we make the assumption that this coupling is to deal with speech-frequency currents. In Fig. 31*b* the essential points of the circuit are reproduced in skeleton form; V1 is represented by a generator driving current through C and R in series, while V2 is seen to receive whatever voltage this current may develop across R in its passage. Since the reactance of C will be highest at the lowest frequencies we have to enquire whether we shall obtain adequate transmission of low notes with the values given on the diagram.

We will take 100 cycles as the lowest note of interest, and find the reactance of C, of capacity 0.001μF, at this frequency. This is given by $X=1/2\pi fC=10^{12}/(200.\pi.1{,}000)=1.59M\Omega$. This in series with $R=1M\Omega$ gives a total impedance $Z=\sqrt{1.59^2+1^2}=1.88M\Omega$. For every volt developed at the anode of V1, $1/1.88=0.53$ microamps. will flow through C and R, developing across the latter 0.53 volt. At 100 cycles, therefore, 53 per cent. of the voltage available at V1 will reach V2.

At 1,000 cycles the reactance of C will be only 0.159MΩ, so that the total impedance will be $\sqrt{0.159^2+1^2}=\sqrt{1.0254}=1.0126$ MΩ. Each volt at the anode of V1 will now drive a current of $1/1.0126=0.988\mu A$, developing 0.988 v. on R. At 1,000 cycles, therefore, 98.8 per cent. of the voltage available at V1 will reach V2. The values for C and R suggested will thus pass on 100-cycle notes at little more than half the amplitude of 1,000-cycle notes; C is not large enough in capacity. By increasing its capacity ten-fold the figures just worked out for 1,000 cycles will be correct for 100 cycles; since a loss of a mere 1.2 per cent. at this frequency will certainly not be noticeable, the combination of 0.01μF for C with 1.0MΩ for R will be satisfactory, even down to the lowest frequency we need to consider.

DISTANT RECEPTION NOTES

WHEN towards the end of the summer large spots made their appearance on the surface of the sun it seemed that the minimum period might have come to an end considerably before it was expected to do so, and that we might be already on the way towards another sunspot maximum. Atmospherics during the late summer and early autumn were something more than a nuisance, and many of us began to fear that during the winter long-distance reception would show a falling off from that of previous years.

Happily these forebodings have not been fulfilled. For some weeks now atmospherics have hardly been heard, and there has never been a time at which the number of stations receivable at full loud-speaker strength and without interference was anything like so great as it is now.

The most crucial test of medium-wave long-distance reception is the way in which American stations are behaving. In my last notes I mentioned that certain American stations might be heard as early as 11 p.m. This still holds good, and those receivable after midnight are still increasing. The strength at which they can be pulled in is quite astonishing. Many reports of reception—at telephone strength, of course—with single-valve or two-valve sets reach me, and I have a special biscuit waiting for the first authenticated report of transatlantic reception with a crystal.

What a pity it is that the French cannot put their broadcasting affairs in order. There is now a movement on foot for the repeal of the Wireless Act and for a complete revision of wireless affairs in France. If the regional scheme is radically altered by the repeal of the Act the Lucerne Scheme may be jeopardised. France has already a good many more stations than she can really need. Many of those sentenced to be closed down are fighting for their lives, and if they win it will be a sad day for Europe.

A glance at the U.I.R. report from the Brussels Laboratories for any recent month will show that certain of the French stations are making no attempt to keep to their Lucerne channels. Both Radio LL and Radio Bezier, for instance, have the distinction of never having used the same wavelengths on any two consecutive nights in October. I think I am right in saying that in recent months hardly one French station on the medium waves has had a clean record as regards frequency keeping!

The Spaniards are perhaps equally bad offenders, and a great deal of trouble has been caused by the wanderings of stations such as Radio Hispaña, Barcelona and Valencia. If Spain has caused less trouble than France it is due purely to the fact that she has fewer stations.

Before now I have referred to the menace of harmonic interference on the medium waveband. How serious this is at the moment is witnessed by the fact that Radio-Paris is causing two heterodynes with different harmonics, whilst Wilno, Athlone, Florence, our own North Regional, and Söttens are responsible for one apiece. The generation of strong harmonics by a high-powered station is equivalent to its occupation of two, three or more channels, and it is undoubtedly a matter that calls for intensified research work.

On the long waves the choice of stations is not great at the moment owing to interference caused by overcrowding. The best of the stations are Huizen, Radio-Paris, Zeesen, Motala, Luxembourg, Kalundborg and Oslo, all of which are receivable clearly and well more often than not. Most of them, however, are liable to interference at times.

On the medium waves one's choice is now very wide, though one or two of the more important stations have been rather below their best during the past week or two. Amongst these are Lyons, Doua, Stockholm, Söttens, Milan and Hilversum. Stations which are quite reliable are Hamburg, Berlin, Frankfurt, Trieste, Leipzig, Munich, Rome, Cologne, Prague, Brussels No. 1 and No. 2, Vienna, Stuttgart and Budapest.

D. EXER.

FOR VALVE TESTS

A useful set of adaptors (with both split-anode and split-grid connections) for 5-, 7-, and 9-pin valves has just been produced for use with Pifco testing instruments.

MY HOME SET.—IV.

A Further Step Towards Perfect Reproduction

By M. G. SCROGGIE, B.Sc.

THIS is the fourth of a series of articles in which contributors reveal the hitherto unpublished secrets of the receivers which they themselves have designed for their own use and which are unfettered by sordid considerations—receivers that are of especial technical interest because they are unlike other receivers. A fascinating feature of this particular example is that no patent rights are claimed; it has been decided that the many novel methods which it holds should be freely released for the benefit of mankind.

PRECEDING contributors have, creditably enough, described their solutions of the problem of reproducing broadcast programmes free from distortion. Naturally, then, their receivers bear little relation to those known to commerce. While it is a step in the right direction to have produced a set which is practically free from distortion, complete satisfaction with such a result is only to be deplored.

In the campaign for better reproduction the war must be carried, so to speak, into the enemies' country. Some of the lines of attack along which the writer has moved may be of interest to the more intelligent readers. So far from claiming that finality has been reached, he unexpectedly corroborates the lay journalist in announcing to an astonished world that wireless—this new wireless—is in its infancy. A sort of second childhood, in fact.

In the following description of the apparatus, details of the methods employed for obtaining complete absence of distortion are omitted for the sake of clearness. The information is necessarily confined to those features that are believed to be novel.

The First Stage

Outstanding among these is the provision for completely compensating for the microphone and transmitter. A distortionless loud speaker and receiver (such as might be described in any other article in this series) are first used to reproduce the programme, as transmitted, in a sound-proof and acoustically "dead" chamber. In passing, readers who are keen to pick up bargains may be glad to know that this portion of the equipment was acquired as a result of the glut of old studios thrown on the market since the B.B.C. started building Broadcasting Houses everywhere.

In this apartment are installed samples of all the different types of microphone used by the B.B.C. The need for employing one of the very largest studios is therefore obvious. Any of these microphones can be connected by a selector switch to an amplifier incorporating a "reversing" circuit which causes the output to be distorted inversely according to the microphone characteristic. The details of this circuit are not yet definitely fixed, and, in any case, are much too ingenious to be described here. Having, as the result of a brief aural test, selected the type of microphone which is at the moment in use for broadcasting, the selector switch is set to that type: and the two distortions, being in opposition, cancel out completely. A somewhat similar scheme was arranged to deal with transmitter distortion. In the days of Writtle and the early B.B.C. relay stations it was a simple matter to install corresponding types of transmitters, each with a reversing circuit, but more recently considerations of finance have rendered this course less convenient. The difficulty has been overcome, and at the same time considerable simplification of the receiver itself effected, in a manner to be described later.

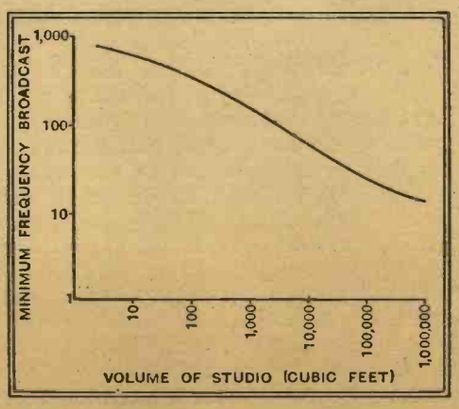


Fig. 1.—Graph to illustrate relationship between frequency and studio dimensions.

The control engineer remains to be corrected. From the output of an early stage of amplification a 101-stage band-pass filter excludes the frequencies traceable to sounds made in the vicinity of the microphone by musicians and other voluntary agents and selects the microphone hiss. The corresponding signal is extensively amplified by an auxiliary amplifier, and the rectified output voltage used to control the main audio amplifier in the manner used in A.V.C. The efforts of the control room are thus completely nullified, and the reproduced volume corresponds exactly to that of the original performance.

Effective though this device is during the continuance of any given item of the programme, it fails to cope with the situation created when, for example, brass band selections are interspersed with announcements of titles, biographical details of composers, and the like; or when the resources of a dance orchestra are temporarily drowned by the plaintive croonings of the so-called vocalist. As the mouths of the announcers, crooners, etc., are brought within a few inches of the microphone, the hiss-actuated decontroller is helpless.

The solution of this difficulty is quite simple. Whenever the modulation of the transmitter exceeds a certain percentage a biased-back diode rectifier connected at a point in the receiver audio amplifier chain passes current and operates a relay which is used to cut down the subsequent amplification by about 30 decibels. By this means broadcast speech, etc., is reproduced at approximately the correct strength in relation to large instrumental combinations.

Delay Action

Of course, the device has to be very cleverly worked out in order to be effective. For instance, in order to prevent the amplification from being restored between the words of speech, the diode rectifier is given a time constant of several seconds. Even this would permit the first syllable to get through before the control came into operation, and it is therefore necessary to delay reproduction for a sufficient period to avoid this. The output from one stage of amplification is used to record the programme as an endless Blattnerphone tape; which, after moving sufficient distance to introduce the necessary time-lag, supplies the programme to the input of another amplifier. The automatic announcer control is operated by the first amplifier, but controls the second; and has completed the attenuation before the danger arrives. The rectifier time-constant sees to it that the amplification is not restored before the danger has passed.

The same delay action enables other valuable features to be incorporated, such as the pip-extractor. A filter, sharply tuned to the frequency of the Greenwich time signal, enables that signal to operate a valve which throws into the main amplifier another filter connected to suppress the signal frequency. As the suppression takes place only momentarily, the artistic effect of the programme is hardly affected; even in the unlikely effect of a vital part of the music coinciding in frequency with that of the time-signal. Alternatively, the time-signal can be diverted to another recorder, whence it may be reproduced on a more convenient occasion, as the listener may feel disposed.

My Home Set—

On those occasions when no desired programme is being transmitted during the Greenwich time-signal, another relay flies back and puts the pip-extractor out of action, thus allowing the time-signal to be heard.

A serious handicap in the search for entirely natural reproduction is that the programmes originate from all sorts of studios, such as Westminster Abbey or a soap box on the Centre Court at Wimbledon; whereas one room is expected to serve for all listening. If one draws a graph with the size of the studio plotted against the minimum frequency broadcast from it, one gets a result somewhat as shown in Fig. 1. It will be noticed that, when the frequency is very low, the size of studio is large. It is unusual for the pedal notes of a cathedral organ to be blown in studio 4B at Broadcasting House (News Bulletins and Market Prices for Farmers).

Room Flexibility

The listening room has therefore been fitted with a rather unusual form of volume control. It has been made on the plan of the old torture chambers that contracted and crushed their claustrophobic victims.* But in this case a stop has been fitted to fix the lower limit of volume at approximately the Centre Court commentary box capacity. The maximum volume to which the room can expand is slightly greater than that of Olympia, in case the B.B.C. may, in future, move into more commodious premises fitted with an organ having 256-ft. pipes. The walls are shifted by a group of 150 h.p. electric motors (fitted with interference suppressors) controlled from an auxiliary amplifier fed through a filter network which progressively favours the low frequencies. A circuit of very long time-constant prevents frivolous changes in the volume of the room, ensuring that it shall remain approximately constant for the duration of a programme item.

An imperfection of the system is that it shuts one up closely with a soprano; but it is hoped to devise a cure for this, and research is actively in progress to this end.

The walls, incidentally, are of the piezo-electric type; and form the reproducer. The disadvantage of the usual piezo-electric loud speaker is that, owing to its small size and restricted amplitude, it reproduces adequately only the high notes. With the modification described, not only are the dimensions of the vibrating surfaces sufficient to deal with the whole gamut of musical frequencies, but the size automatically adapts itself to the lowest notes actually present.

Here again, perfection has not yet been attained. As is well-known, the motion of the piezo-electric crystal is proportional to the voltage applied across opposite faces. During a thunderstorm, when voltages estimated by competent scientists to exceed 1,000,000,000 are generated, the stability of the house is gravely imperilled. Compared with the more conventional types of modern residential structure, however, it may be considered entirely satisfactory.

Circuit Disclosed

Fig. 2 is a schematic diagram of the whole installation. This shows one unit only; it must be understood, however, that it is in triplicate, and that in the event of a break-down of one unit there is an automatic switch-over to another. The third is provided in case the fault in the first has not been cleared by the time the second gives out. Although many of the advantages of this receiver are not readily applicable to commercial sets, the triplication feature is one which should make an instant appeal, seeing that many tobacconists, fishmongers, etc., have not the leisure to acquaint themselves with the servicing of all the sets that they supply.

Water-cooling Troubles

The only trouble which has been experienced in the practical working of the apparatus has been with the Water Board, who have taken advantage of the droughts of the last year or two to adopt a niggling attitude with regard to the cooling water for the amplifier output valves. These require about 200 gallons per minute, and it is suggested by them that this constitutes an industrial load and is not covered by the ordinary domestic rate. Seeing that even the G.P.O. permit the set to be operated under the ordinary private domestic listeners' licence this tiresome hair-splitting is one more example of bureaucratic ineptitude.

Television has deliberately not been incorporated, because if carried out along the lines herein described it would provide a perfectly faithful image of the performer. It is felt that sometimes science can go too far.

Readers who have been skimming through this article to discover how it has been found possible to achieve perfect reproduction without introducing interference from the station next in frequency, no doubt have a feeling of disappointment. This is justifiable; for, in order to circumvent insuperable difficulties, a private line has been rented (by very special arrangement) direct from the B.B.C. control room.

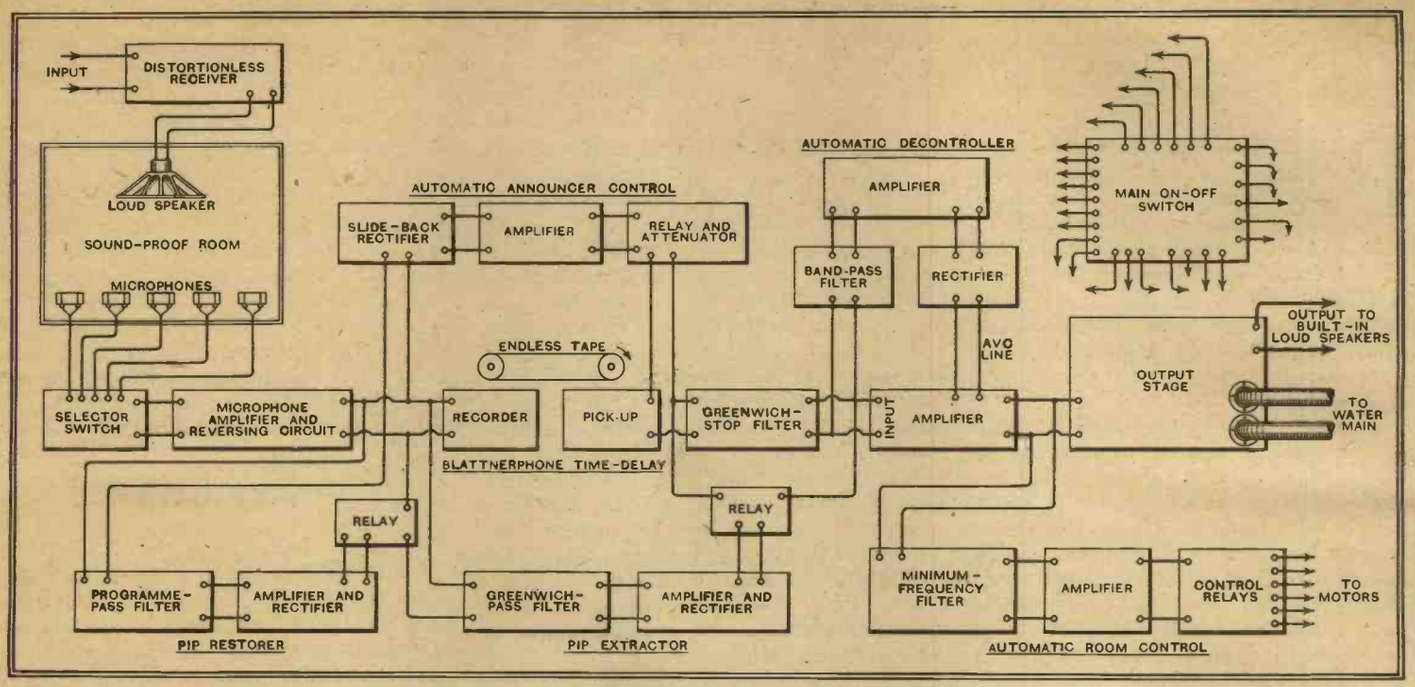


Fig 2.—Schematic diagram of the author's home set.

* "*The Iron Shroud.*" (Anon.)

"WHAT THE EYE DOESN'T SEE . . ."

APART from making tests and working to very close tolerances on completed sets, we do a good deal of checking both of raw materials and individual components in the same way. This extreme accuracy of manufacture both mechanically and electrically is not always apparent on sight.

As an illustration of this, we instance the Murphy mains transformers. We are very pleased with ourselves about these. They practically never give trouble, and *we* say they are well made (even if it does mean blowing our own trumpet). To give you an idea of the amount of care taken in producing just this one item, we set out below the various tests made. These, we think, are essential to ensure that every transformer not only does its job well when the set is sent from the factory, but also during the whole working life of the set.

1. ***Tests on Raw Materials used in making the Mains Transformers.***

Presspahn for bobbins, checked for quality, thickness and surface scratches.

Steel sheet for stiffeners, Steel strip for legs, Brass for contacts (tags) } Checked for thickness, hardness and surface.

Varnished tape checked for quality, thickness and width.

2. ***Intermediate Tests during Manufacture.***

All parts made in Machine Shop, e.g., panels, legs, bobbin parts, stiffeners, tags, given a general inspection.

Engraving on panel inspected for filling.

Riveting of tags and mounting of sockets inspected.

Empty bobbins inspected.

Full bobbins inspected for finish, continuity, insulation, shorted turns, and number of turns. Laminations for iron core checked for thickness.

All plated parts inspected for appearance and quality of deposit.

3. ***Final Tests.***

General mechanical inspection of transformer. This includes soldered joints, appearance, rigidity of assembly and gauging of fixing holes in legs for correct location.

Insulation between windings and between windings and core tested at 1,000 volts D.C.

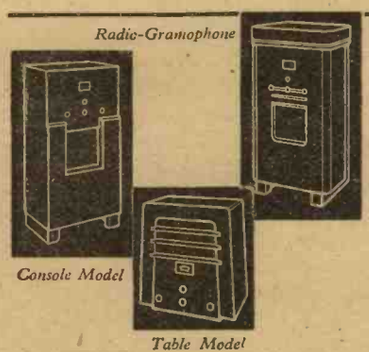
Dummy loads connected to transformer and all output voltages checked under operating conditions.

Check on lamination buzz during this test.

Two hours "soak" test in the set itself. (This is a test in which the set is left running for two hours, and then reinspected for simple faults which may have become apparent.)

Some of these tests may seem unnecessary to the layman—It is a fact that many of them do not affect the working of the transformers—*But* (and it is a very big *but* from our point of view) we do insist upon making as certain as we can that every component will go on doing its job indefinitely. It is only by this continual checking that reliability in manufacture is ensured.

E. J. POWER,
Chief Engineer.



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ON WITH THE NEW

Here is our last message of the old year. Our cordial thanks to all those connoisseurs who have entrusted us with their orders. The sale of Hartley-Turner specialities has exceeded our wildest hopes, but it has been something of a mixed blessing, for, whilst we will only sell products which are as good as we can make them, we also try to give the sort of service we expect others to give us. During the past month our deliveries have not been too good, simply because our works could contain no more men, and *the whole staff has been working overtime for three months. It was not possible to produce more goods of Hartley-Turner quality.*

We are changing all that. We have acquired a new *additional* factory more than six times larger than the old, but it will be appreciated that the transition period makes things more difficult than ever.

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(3) To maintain stock, so that the new convert will get what he wants when he wants it, by removing, wherever possible, our dependence on outside suppliers.

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UTILITY SALES, Faeritone Corner, 57, Praed St., London. Paddington 0251. [7292

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1935 Manufacturers' Stock 4-valve A.C. Band-pass Receivers, Mazda valves, Rola speakers, walnut cabinet, £5/10; 5 valve A.C. Superheterodynes, £6/5; approval against cash.—Maude, 1, Martin St., Brighouse. [7285

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Receivers and Amplifiers, Etc.—Contd.

DEGALLIERS Offer Brand New 1935 Receivers, Midgets and otherwise, every set guaranteed in this country against faulty workmanship for 12 months, each in handsome walnut cabinet, complete in every detail, ready to plug in; receivers covering ultra short wave bands guaranteed to get stations on those bands, including America; illustrated lists available of sets advertised over £6/5, S.A.E. with all enquiries.

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£3/12.—Limited number 4-valve T.R.F., very selective, complete; carriage 1/6.

£6/5.—R.C.A. "Midget," 11¼×7×5¾, 5-valve superhet, A.C./D.C. 100-250 volts, M. and L. wave, A.V.C., tone control, illuminated dial, M.C. speaker, approx. 50 stations; carriage 2/6.

£7/10.—R.C.A. "Midget," operates on A.C./D.C. 200-250 volts, approx. 80 stations, 6-valve superhet, 18-50, 100-550, and 1,000-2,000 metres, illuminated dial, A.V.C. tone control, pick-up terminals, M.C. speaker, cabinet 12×8½×6, 2 watts undistorted; supplied less cabinet at £7/5, carriage 2/6.

£7/5.—R.C.A. "Table Model," 14×16×10½, A.C. 200-250 volts, 190-550 and 1,000-2,000 metres, approx. 90 stations, 3½ watts undistorted, 5-valve 7-stage superhet A.V.C., illuminated aeroplane dial, P.U. terminals, 8in M.C. speaker; carriage 4/9; universal model available. A.C./D.C. 200-250 volts, at £7/10; without cabinet, deduct 12/- on each model.

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FIRST Consignment of the Genuine Emerson 1935 "Round the World" 6-valve Superheterodyne, 19-2,000 metres, 3 separate wavebands, acclaimed by trade as the best all-wave receiver yet produced, aeroplane dial tuning, "Duo-Lite" band switching, dynamic speaker, automatic volume control, gramophone pick-up, walnut cabinet 16½in. high, 13¼in. wide.—Write for wholesale catalogue to Importer, Royal Radio Co., 5, Buckingham Rd., South Woodford, London, E.18. [7252

Receivers and Amplifiers, Etc.—Contd.

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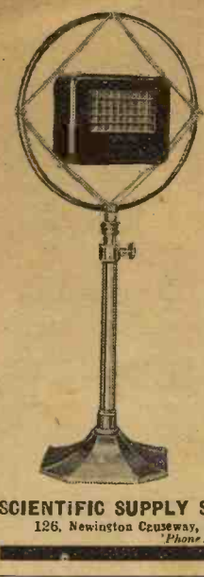

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PAIR Varley P.P. Transformers, 22/6; Bulgin 20H. choke, 4/-; new type Varley Hypermu, unused, 9/-.

SET Varley Air Coils, 2 H.F., on baseplate 3, 15/-; set G1/2/3, 17/6; set G10/14/8, 17/6; Ferrocart intermediates, 6/-; Polar minor straight 3-gang, with moving scale drives, 10/9.

PAIR Varley Nicore, Aerial and H.F., on baseplate, 15/-; Varley B.P.22 oscillator coils, 3/-; Eckersley tuner, 5/-; Whiteley Boneham, 42/-; Microlode P.M., 25/-; Amplion M.C.22, 22/6; Telsen electric power pentode chokes, 4/6.

MARCONI Shrouded 25-1 Output Transformer, 4/9; Savage tapped choke, 50H., 50 m.a., 735 ohms, 7/9; Challis 500-0-500v. transformer, with 3L.T. windings, for W.W. amplifier, 16/-; R.I. L.T. 3-amp. choke, shrouded, second-hand, 5/9; radiophone 2 H.F. pack, 30/-.

UTILITY 3-gang Straight, with disc drive and cover, 6/6; R.I. Dux chokes, second-hand, 5/-; R.I. Paraleed unit, second-hand, 6/6; Heayberd H.T.10 transformer, with L.T. and H.T.10, 27/6.

GAMBRELL Type M Novotone, 15/-; Gambrell senior standard Novotone, for medium resistance pick-ups, 20/-; Varley 300 H choke, 10/6; Ferranti output transformer, 27/50-1, 8/-; pair Lissen screened coils, 4/9; Varley double ratio output transformer, 5/9.

BRITISH GENERAL Tuner, 4/9; Ferranti O.P.1 1-1 output transformer, 5/9; Ekco 15/20 D.C. eliminator, 15/9; Supremus A.C. unit, 200v. 30 m.a., Westinghouse rectifier, single output, 15/9; valve rectifier unit, complete, 150v. 50 m.a., 8/6.

RADIOPHONE R.F. Pack, superhet 117.5 kc., new, 35/-; Rothermel brush cone unit, list 45/-, 15/-; Ferranti B1 choke, 10/-; Wearite type M class B chokes, 6/-; Universal driver, 5/-.

FERRANTI A.F.5c, soiled, 15/-; A.F.7, 16/9; A.F.5c.s., as new, 22/6; A.F.6, 15/9; A.F.4, 7/6; A.F.10, 3/6; O.P.M.17c., 8/6; O.P.M.12c., 7/9; A.F.5c.c., 21/6; O.P.c., 2-1 P.P., 5/9.

FERRANTI Meters, portable type, 10/50/250v., 35/-; 10/250v. 50 m.a., 35/-; flush type, 0-250v., 30/-; Ferranti valve tester, V.T.1 D.C., 55/-; all 1,000 ohm per volt, Hunts flush 0-50 m.a., 13/6; Sifam 0-200 m.a., flush, 13/6, new; Turner 0-100 m.a., flush, 15/-; Sifam 0-240v. 500 O.P.V., 15/-; Weston bakelite cased 0-500 m.a., flush, 301 type, 20/-.

J.B. Nugang Three, superhet, type, with disc drive, 12/6; Polar Minor 3-gang, with moving scale drive, 11/6; Polar Star 3-gang super, with D.D., 10/6; Radiophone 3-gang superhet, piano type midget or standard, new, 10/9; all 0.0005.

PAIRS Coupled Radiophone Pots, 5,000 and 50,000, new, 5/-; Bulgin tapped shrouded resistance, for D.C. ¼ amp. valves, 7/6; Lewcos super 60 coils, 4/-; oscillators, 6/-; set 3 Telsen canned coils, B.P. and H.F., 10/-, less switch rod.

SEE Last Week's and Next Week's issue for Details of Rest of Goods Available.

R. [7291

VAUXHALL.

VAUXHALL.—Radiophone Radio Paks, R.F. superhets, 110 of 117 kc., complete with volume controls, escutcheon plate, etc., brand new station named dials new Lucerne and metres; 34/-.

VAUXHALL.—I.F. transformers, 110 or 117 kc., centre tapped on bases with fixing terminals; 4/6 each.

VAUXHALL.—3-gang condensers and set iron cored coils, specially matched for S.G. det. pentode, complete with dial, drive, escutcheon, etc., 35/-; as above, suitable for Band-pass or R.F. superhet, 37/6; gramophone switches, 3/6.

VAUXHALL.—"Utility" dials and drives, complete with escutcheons, just issued, black or brown; 5/-.

VAUXHALL.—Radiophone 3-gang superhet or 3-gang Straight Midget type condensers, brand new, sealed boxes; 8/6.

VAUXHALL.—Benjamin Class B transformers, 1-1¼ to 1, 6/6; Radiophone, Class B, 10/-; volume controls; Radiophone, with switch, 5,000 to 500,000, 3/6.

VAUXHALL.—Set manufacturer's surplus. Skeleton type Westinghouse rectifiers; H.T.8 9/6, H.T.9, H.T.10, 10/-; Westectors, W.4, W.X.6, 5/9; mains transformers, fitted with screened primary, 300-300v. 60 m.a., 4v. 2.5a. 4v. 4a., impregnated windings, 11/6; Niclets, 5/9.

VAUXHALL.—Rothermel Piezo electric pick-ups, 30/-; B.T.H. Minor, 16/6; Senior, needle armature, 29/-; Radiophone, 14/6; others from 10/-; B.T.H. Truspeed gramophone motors, 30/-; Collaro 32 model, 32/6; complete unit A.C., 200-250v., first quality pick-up and volume control, 48/-, sealed cartons.

VAUXHALL.—Dubilier condensers, 4 or 8 mfd., dry electrolytic, 500v. working, 3/-; 50 mfd., 50v. working, 1/8; tubular non-inductive, 0.1 9d., 0.05 6d., 0.002, 0.0002, 0.001, 0.0001, 4d. each; T.C.C., mica, 0.002, 2,000-volt test, 10d.; 0.0001, 4d.; 0.001, 0.01, 1/-; 1 mfd. Mansbridge, 1/3.

VAUXHALL.—Dubilier resistances, 1-watt type, 7d. each, all values; Clix valve holders, terminals, 7-pin 9d., 5-pin 7d.; W.B. 5-pin, 4½d.; post paid 2/6 or over, or c.o.d.

VAUXHALL UTILITIES, 163a, Strand, W.C.2; over Denny's the Booksellers. Temple Bar 9338. Send postcard for lists free. [7286

ANDERSON.

A LARGE Selection of Surplus Parts for Sale at Keen Prices, including Ferranti meters, transformers, also some first class speakers, at various prices; sets and all various parts; send for price list, and your requirements.—J. F. Anderson, 35, Landsdowne Rd., Walthamstow, E.17. [7213

RESISTANCES, colour coded, wired ends, 1-watt, new, assorted values 100 to 50,000 ohms; 3/- dozen.—Epton, 93, New Road, Chingford, E.4. [7283

FERRANTI Multi-range D.C. Test Set, new, guaranteed perfect; £4; would consider exchange automatic record changer, cash adjustment.—Jones, Trentham, Council St., Llandudno. [7276

AVOMETER Universal and Adapter, £9; Avominor, 30/-; Weston C-450 volts, 22/-; Sifam 0-120 volts, 8/-; laboratory milliampmeter, 0-25-500, 35/-; all moving coil; exchanges.—Langley Knight, 42, Thorpe Crescent, E.17. [7266

Components, Etc., for Sale.—Contd.

PREMIER SUPPLY STORES

ANNOUNCE a City Branch at 165 and 165a, Fleet St., E.C. (next door to Anderton's Hotel) for the convenience of callers; post orders and callers to High St., Clapham.

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra; I.F.S. and abroad, carriage extra; orders under 5/- cannot be sent c.o.d.; please send for illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v. 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker; £12/10.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagrams, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amp., C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps., C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps., 25 hys., 4/-; 65 milliamps., 30 hys., 5/6; 150 milliamps., 30 hys, 10/6; 60 milliamps., 80 hys., 2,500 ohms, 5/6; 25 milliamps., 20 hys., 2/9; 250 milliamps., 30 hys., 20/-.

ALL Premier Guaranteed Mains Transformers Have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; with Westinghouse rectifier, giving 200v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v. 60 m.a. and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a., and 4v. 1-2a., C.T., L.T., and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Mains Transformers, output 350-0-350v. 130 m.a., 4v 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary; 10/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt; 10/-.

WESTERN Electric Mains Transformers, 300-0-300v. 65 m.a., 4v., 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a., C.T., 4v. 1a., C.T.; 19/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-110v. or 200-250v., output 180-0-180v., 40 m.a.; 4v. 1 amp., 4v. 3 amps., 4/6; 200-0-200v., 4v. 1a., 4v. 3a.; 4/6.

PREMIER L.T Charger Kits, consisting of Premier transformers and Westinghouse rectifier, input 200-250v A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/- complete; ditto, D.C., 47/6.

COLLARO Gramophone Unit, consisting of A.C. motor, 200-250v., high quality pick-up and volume control, 49/-; without volume control, 46/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job; 15/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000-100,000, ½ meg., any value, 2/-; 200 ohms, wire wound, 1/-.

POLAR Star, manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Utility bakelite 2-gang 0.0005, screened, with uniknob trimmer, 3/6; Polar bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

ORMOND Condensers, 0.0005 2-gang semi-shielded, 2/6; brass vanes with trimmers, 3/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna., 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 16/6; 9in. cone, 22/6.

RELIABLE Canned Coils with Circuit Accurately Matched, dual range, iron cored; 2/11.

UTILITY 3-gang Condensers, 0.0005, fully screened, with trimmers, ball bearing, straight or superhet., 6/9; complete; with disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-; 2 mf., 750v. working, 3/-.

VARLEY Constant Square Peak Coils, band-pass type B.P.7, brand new, in maker's cartons, with instruction and diagram: 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instructions, in original cartons; 2/6.

SCREENED H.F. Chokes, by one of the largest manufacturers in the country; 1/6.

PREMIER British-Made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000 500,000, 2/- each; 1,000 ohm, semi variable, carry 150 m.a., 2/-.

PLESSEY Pick-up and Arm, 15/-; Cosmocord pick-up, with arm and volume control, 10/6.

RELIABLE Intervalve Transformers, 2/-; M.C. Multi-ratio output transformers, 2/6; 2-1 or 1-1 output transformers, 2/6; microphone transformers, 50 and 100-1, 2/6.

MAGNAVOX Super 66 Power, pentode and push-pull transformer, 2,000 ohm field, £4/4; energised for 200/250 A.C., £5.

BLUE SPOT 45 P.M. Speaker Multi-ratio Transformer, handles 4 watts; listed 45/-, at 25/-; or in handsome walnut cabinet, 35/-.

BLUE SPOT 99 P.M. Speaker Multi-ratio Transformer. Handles 5 watts; listed 59/6, at 31/-.

(This advertisement continued in third column.)

USE A

TRANSFORMER

WITH A NAME BEHIND IT!!

METAL-RECTIFIER TRANSFORMERS

Model.	Rectifier.	Rectified Output.	Price.
W.30	H.T.8	200 v. at 60 m/a 250 v. at 60 m/a	21/-
*W.33	H.T.9	300 v. at 60 m/a	32/6
*W.34	H.T.10	200 v. at 100 m/a	34/-
*W.35	H.T.11	400 v. at 120 m/a 500 v. at 120 m/a	52/6

*Supplied with two 4 volt. L.T. windings.

VALVE TRANSFORMERS

Model.	Output.	Price.
803	250+250 v. 75 m/a 2+2 v. 1 amp, 2+2 v. 5/6 amps.	29/-
805	350—250+250—350 v. 120 m/a 2+2 v. 2.5 amps, 2+2 v. 5 amps, 2+2 v. 2 amps.	49/6
806	500+500 v. 120 m/a 2+2 v. 2½/3½ amps, 2+2 v. 5/6 amps. 2+2 v. 2 amps.	59/-

INSIST ON—

HEAYBERD

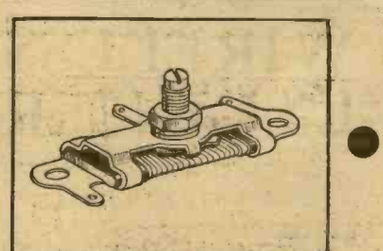
Send coupon together with 3d. in stamps for our latest 1935 HANDBOOK "MAINS POWER FOR YOUR RADIO."

Mr. .....

Address .....

.....

F. C. HEAYBERD & CO., 10, FINSBURY STREET, LONDON, E.C.2.



DOES *YOUR* SET SUFFER FROM "HUM-M-M-M"?

There is nothing so annoying as "mains hum." This persistent, low-pitched "Hum-m-m-m-m" just worries you to the point of distraction. You may spend much time which might be spent in pleasurable, relaxing listening, and still not cure that "Hum-m-m-m-m." Also, perhaps, waste much money.

There is a CLAUDE LYONS Half-Crown Gadget which quite definitely will cure this trouble in any *A.C.-operated* Radio, Radiogram or Amplifier.

Just walk into the nearest good Radio Dealer and ask for a CLAUDE LYONS TYPE HD-30, 30-Ohms "HUM-DINGER" (Regd. Trade Mark No. 503,668—none genuine if this mark is not engraved on it). Total cost 2/6, complete with full instructions.

If you have any difficulty in securing this little gadget, send our nearest office a P.O. for 2/6, and we will despatch, post free, per return. Free descriptive leaflet on request.

CLAUDE LYONS LTD.

76, OLDHALL ST., LIVERPOOL

LONDON OFFICES:

40, BUCKINGHAM GATE, S.W.1

Components, Etc., for Sale.—Contd.

(This advertisement continued from first column.)

SUPER Moving Coil Speaker by World Famous Radio and Gramophone Co., 10,000 ohm field (300v. 30 m.a.); 25/-; handles 10 watts.

PREMIER H.T.11 Transformer, 500v. 120 m.a., or 450v. 150 m.a., rectified, with 3 L.T. windings, 22/6; with Westinghouse rectifier, 42/6.

DARIO Valves, 4 volt battery type, H.F., R.C., L.F., power, 1/6 each; 4v. directly heated mains power, 1 watt, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers at a fraction of original cost; send for list.

THE Following Lines 6d. each, or 5/- Per Dozen; Chassis valve holders, 5-, 6-, or 7-pin screened screen-grid leads, any value 1-watt wire resistances, wire end condensers, 0.0001 to 0.1, 3 amp. main switches, Cyldon capacitors, double trimmers.

SCOTT Aerial and Anode Coils, dual range, complete with circuit; 2/6 per pair.

BLUE SPOT 29 D.C. Moving Coil, with multi-ratio transformer, 7in. cone, 2,500 ohms, 9/11.

ELPHRO Volume Controls, 10,000, 12,000 or 15,000 ohms, complete with mains switch; 1/-.

T.C.C. Electrolytic Condensers, 8 mf., 440v. working 3/-; 4 mf., 440v. working, 3/-; 15 mf., 50v. working, 1/-; 50 mf., 12v. working 1/-; 15 mf., 100v. working, 1/3; 6 mf., 50v. working, 6d.; 2 mf., 100v. working, 6d.; 8+4 mf., 450v. working, 4/-.

DUBILIER Dry Electrolytic Condensers, 12 mf., 20v. working, 6d., 50 mf., 50v. working, 1/9.

CONDENSER Blocks, H.M.V., 400v. working, 4+2+1+1+1+0.5, 3/9; 2+2+1+1+1+0.5, 3/-; Dubilier 300v. working, 4+4+2+0.1, 3/-; Philips 6+4+2+1+1, 4/6.

RADIOPHONE Logarithmic Wire Wound Potentiometer, 10,000 ohms, with mains switch, 2/-; S.W. H.F. chokes, 10-200 metres, 9d.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World-famous Continental Valve Manufacturer, all the following standard mains types, fully guaranteed, 4/6 each; H.L., L., power, medium, high, low mag. and variable mu screen grids, 1-, 3- and 4-watt A.C. output, directly heated pentodes, 250v. 60 m.a., full wave rectifiers, D.C. types, 20v. 18 amps., filaments, screen grid V.M., H., H.L., power.

THE Following Types, 5/6 each: 350v., 120 m.a., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½-watt indirectly heated pentode.

THE Following American Types, 4/6: 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27.

THE Following Types, 6/6 each: 42, 77, 78, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A5, 2A6, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for catalogue of above types.

PREMIER SUPPLY STORES,

20-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest Station: Clapham North (Underground). [7240

SOUTHERN RADIO'S Wireless Bargains.

RECEIVERS.—G.E.C. Osram 4-valve (actual) sets, complete with 4 Osram valves, permanent magnet moving coil speaker, magnificent pedestal cabinet, ready to use on all voltages A.C., all Osram proprietary components in original sealed cartons; £6/15 (list £15/15); an exceptional bargain.

CROMWELL 3-valve Battery Sets, complete with three Cossor valves, permanent magnet moving coil speaker in magnificent walnut console cabinet, brand new, in original sealed cartons; £3/12/6 (list £8).

BURGOYNE Class "B" Receivers, brand new, in original sealed cartons, complete with 3 Mullard valves, Exide batteries and accumulator, P.M. moving coil speaker, contained in attractive cabinet, magnificently finished with chromium fittings; £3/19/6. (list £6/10).

LISSEN 2-valve D.C. Receivers, complete with valves, speaker in attractive bakelite cabinet, ready to work on all voltages D.C.; £2/19/6 (list £7/7).

COILS.—Igranic superhet, set of four (1 Osc., 2 L.F. with pigtails, 1 L.F. plain), 12/6 (list 50/-); Lissen superhet, 3-coil kit, screened, ganged on base with switch, type L.N.5181, 9/6; same description for band pass or any straight circuit, type L.N.5162, 7/-; Varley constant square peak coils, B.P.5, complete with all accessories in sealed cartons, 2/3; Lewcos, O.S.C./126 (extensor) T.O.S./R. all at 3/6 each.

PICK-UPS.—Marconi model K.25 (1935 issue). 21/- (list 32/6).

CONDENSERS.—Lotus 3-gang, 12/6; 2-gang, 8/6; all 0.0005, fully screened with trimmers, complete with dials, knobs and escutcheons; special bargain line, Plessey 4-gang condensers, superhet. type, fully screened with trimmers (less dials) (standard dial will fit), 10/6 (list 45/-); Dubilier block condensers, 4 mfd. (2×1×1), 1,000v., 2/9; 4.5 mfd. (2.25×2.25), 3/-; T.C.C. (0.1×0.01), 1/3 each.

SPEAKERS.—Blue Spot 66R. units, brand new and boxed, 10/6 (list 35/-); complete, mounted on Blue Spot chassis, 16/6 (list 45/-).

BLUE Spot Permanent Magnet Moving Coil Speakers, universal transformer for Class "B," Super Power, Power, or Pentode, all brand new 1935 series, in sealed cartons; type 45P.M., 26/- (list 45/-); 99P.M., 30/- (list 59/6); 62P.M., in magnificent cabinet, 38/- (list 67/6); 32P.M., in exquisitely finished cabinet, 45/- (list 87/6), all brand new.

MISCELLANEOUS.—Set manufacturer's surplus skeleton type Westinghouse metal rectifiers, H.T.6, 7, 8, 9/3; morse tapping keys with flash signal and buzzer, complete with battery and bulb, 2/-; Lissen general purpose output chokes, 20-28 henries, 18-60 m.a., L.N. 5301, 6/- each; Lewcos superhet, dual wave frame aerials, 9/-; utility midget condensers 0.0005, complete with dial, knob escutcheon, 2/6; Bifo static cutouts, definitely cuts out all electrical interference and all unwanted noises without decreasing volume, listed at 12/6, our price 2/3 each; brand new and boxed, with simple instruction leaflet; please state whether A.C., D.C., or battery set; note price, 2/3 (listed 12/6).

THOUSANDS of Bargains for Callers at our Various Shops.

ALL Goods Guaranteed and Sent Post Paid.

BRANCHES at 46, Lisle St., W.C.2; 16, Leicester St., W.; 271-275, High Rd., Willesden Green, N.W.10; all mail orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324. [7224

Components, Etc., for Sale.—Contd.

WOBURN RADIO Offer Following Bankrupt Stock and Manufacturers' Surplus:—

BRITISH Radiophone two-gang Condensers, .0005, with trimmers unscreened, 5/9; Radiophone three-gang condensers, .0005, fully screened with trimmers, straight and super-het, 9/9.

ROTHERMEL Piezo Electric Pick-ups, new 2 guinea model, boxed, 30/-; Marconi K.25 pick-ups, 21/-; Western Electric microphones, 2/3; microphone transformers for same (ratio 85/1), 2/3.

WESTINGHOUSE Rectifiers, set manufacturers' surplus, skeleton type, H.T.8 and 9, 8/11; few only H.T.5 and 6, 4/9; transformers for H.T.8 and 9, with L.T. winding, 4v. 4a., C.T., 6/9; screened flex, 3d. yd.; toggles, 6d.; chassis valve holders, 4-5-pin, 1/3 half dozen, 7-pin, 6d.

ESTON Iron Cored Coils, 2/6; Lucerne iron cored canned coils, 2/6; Columbia 3/1 and 5/1 L.F. transformers, 2/9; Class B driver and choke, 8/6 per pair; with valve and 7-pin holder, 17/-; binocular chokes, 1/2; H.F. chokes, honeycomb wound, 10d.; Sistoflex, 7yds., 6d.; J.B. condensers, .0005 air spaced, with dial, escutcheon and lamp, 3/3; Rothermel Midget P.M speakers, 5in. cone, 12/6.

CONDENSERS.—All blocks as last week; Formo 1 mfd., 1/-; 2 mfd., 1/3; 4 mfd., 2/3; T.C.C. electrolytics, 6 mfd. 50v. working, 15 mfd. 100v. working, 25 mfd., 25v. working, and 50 mfd. 12v. working, all at 1/3; British insulated cables, dry electrolytics, 8 mfd. 550v. working, 3/-; 50 mfd. 50v. working, 3/-; Dubilier 4 mfd. 500v., 3/-; 8 mfd. 500v., 3/-; 50 mfd. 50v., 3/-; T.C.C. tag condensers, types "S" and "M," .001, .0015, .003, .006, .0001, .0002, up to .0009, and .00005, 4d. each; tubular condensers, Wego .01, .02 and .1, 6d.; Wego .25, 9d.

WOBURN Trickle Chargers, 2v., 4v., 6v. 5 amp., 12/6, carriage 1/-.

NEW Trade List Now Ready; send heading and stamp.

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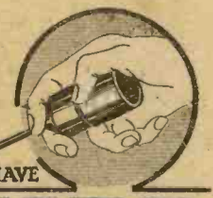

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"The Wireless World" can be obtained abroad from the following: UNITED STATES: The International News Co., New York. FRANCE: W. H. Smith & Son, 248, Rue Rivoli, Paris; Hachette et Cie, Rue Réaumur, Paris. BELGIUM: W. H. Smith & Son, 71-75, Boulevard Adolphe Max, Brussels. AUSTRALIA: Gordon and Gotch, Ltd., Melbourne (Victoria), Sydney (N.S.W.), Brisbane (Queensland), Adelaide (S.A.), Perth (W.A.) and Launceston (Tasmania). NEW ZEALAND: Gordon and Gotch, Ltd., Wellington, Auckland, Christchurch and Dunedin. INDIA: A. H. Wheeler & Co., Bombay, Allahabad and Calcutta. CANADA: Imperial News Co., Toronto, Winnipeg and Vancouver; Benjamin News Co., Montreal; Gordon and Gotch, Ltd., Toronto. SOUTH AFRICA: Central News Agency, Ltd.

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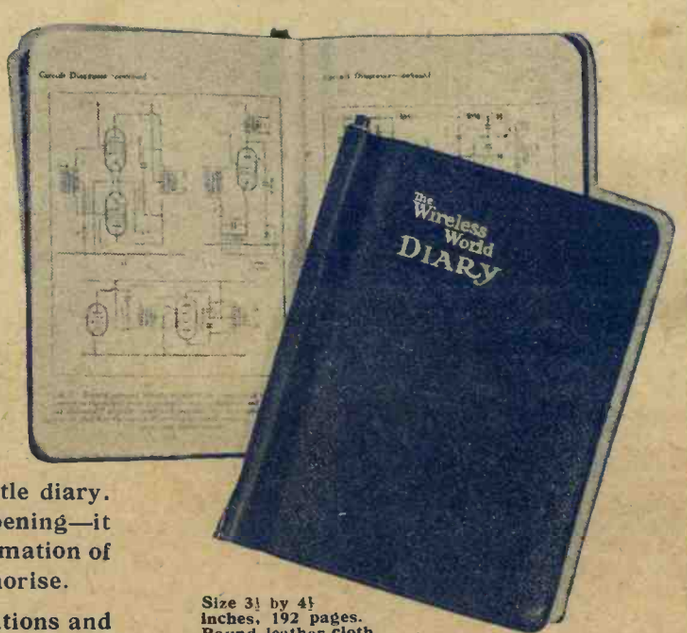

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